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REACHING MATH POTENTIAL

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ABSTRACT

This report contains a summary of findings from a study conducted in California and Nevada to investigate attitudes towards mathematics and extent of parental influence on three groups of high school students--high math-achieving males (N=59), high math-achieving feamles (N=44), and high verbal/low math females (N=27). Differences between Asian American students and parents and non-Asian students and parents were also examined. The report includes data on student math/science achievement, math study habits, educational and career plans, perceived aptitudes and abilities, extent and nature of parental influence, math-related attitudes, and demographic data on parents. Conclusions point up the similarities and differences between high-math females and each of the other two student groups. Among the findings were: (1) parents' efforts can make a substantial difference in encouraging young women in math-related study and careers; (2) all students acknowledged a very low degree of influence from teachers and counselors; (3) high verbal/low math girls reported being least influenced by their parents; and (4) male students and their parents held more stereotyped attitudes concerning mathematics as a male domain. (Thirty-seven tables and eight pages of references are provided. The appendixes include parent and student questionnaires comprising one-fourth of the report.) (Author/TW)

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ABSTRACT

This report contains a summary of findings from a study conducted to investigate attitudes towards mathematics and extent of parental influence on three groups of high school students--high math-achieving males, high math-achieving females, and high verbal/low math females. Differences between Asian American students and parents and non-Asian students and parents were also examined. The report includes data on student math/science achievement, math study habits, educational and career plans, perceived aptitudes and abilities, extent and nature of parental influence, math-related attitudes, and demographic data on parents. Conclusions point up the similarities and differences between high-math females and each of the other two student groups. Among the findings were: 1) parents' efforts can make a substantial difference in encouraging young women in math-related study and careers; 2) all students acknowledged a very low degree of influence from teachers and counselors; 3) high verbal/low math girls reported being least influenced by their parents; 4) male students and their parents held more stereotyped attitudes concerning mathematics as a male domain.

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REACHING MATH POTENTIAL

INTRODUCTION

This report contains a summary of findings from a study conducted by the staff of the Research and Educational Planning Center, College of Education, University of Nevada-Reno, and funded by a grant from the U.S. Department of Education, Women's Educational Equity Act Program.

The need for women to realize their full potentials in the area of mathematics is highly significant both to women on a personal level and to this nation, on a broader level. According to a report prepared by the Department of Education and the National Science Foundation (1980), women constitute one of the greatest pools of underdeveloped scientific talent in this country. Mathematics is not a field that all persons in our population would necessarily be interested in or capable of pursuing; however, many young women do not recognize and utilize their potential math talents and abilities.

Math-related career areas, such as the physical sciences, engineering, and computer science, tend to lead to some of the highest paid occupations. Many women are thus excluding themselves from highly rewarding careers. Each time a bright, high ability woman decides to aim towards a low math-related occupation, she reinforces the sex role stereotype of math as a masculine pursuit, and a much needed source of talent for science and engineering is lost.

BACKGROUND

During the past ten years, literally hundreds of studies have touched on the problems of women and math. One pervasive set of findings has been that

although young women may excel in math during the elementary grades, by the end of high school young men are achieving higher math test scores; these differences tend to show up by ages 13 to 17, and are independent of formal educational experiences (Benbow & Stanley, 1980, 1982, 1983; Levine & Ornstein, 1983; Carpenter et al., 1984; Armstrong, 1980, 1981; Schonberger, 1981; Weiner & Robinson, 1983; Giesbrecht, 1980; Cartledge, 1984; Marshall, 1984; Lewis & Hoover, 1983; and Sherman, 1980a). Some researchers have attributed these differences to a superior mathematical reasoning ability in males. For example, Benbow and Stanley (1983) reported that ... "by age 13, a large sex difference in mathematical reasoning ability exists. ...among students who scored over 700 (on the math portion of the Scholastic Aptitude Test) boys outnumbered girls 13 to 1." In 1984, Arbeiter found that for all high school students who took the math portion of the Scholastic Aptitude Test (MSAT) that year, males outscored females by an average of 46 points. West and Gross (1986) noted that even among students with equal math course-taking histories, Caucasian males averaged 44 points higher on the MSAT.

When given a choice, women tend to enroll in fewer advanced math classes (de Wolf, 1981; DeBoer, 1984); they often find math less interesting and less useful (Fox, 1981; Lips, 1984; Fennema, 1978), have more negative attitudes towards it (Meece, 1981; Kaczala, 1981), have a lower self-concept with regard to math (Burton & Adams, 1984), and suffer more from "math anxiety" (Tobias & Weissbrod, 1980). Becker (1984) found that even female math graduate students who were achieving on a par with males lacked confidence in their own abilities to finish their degrees; and Fennema and Sherman (1978) found that at each grade level, from six through eleven, boys were more confident in their math abilities.

Women also tend to choose traditionally feminine careers which are usually low in math relatedness, and to have generally lower career and educational aspirations. Jacobowitz (1983) noted that even at the junior high school level, girls' career preferences are related more to interests consonant with sex role considerations than to realistic assessment of mathematics achievement and ability. Kerr (1985) found that in a sample of students placed in an accelerated and enriched learning program in middle school, only nine percent of women went on to earn the doctorate or other advanced degree, whereas 33 percent of men did so.

A number of explanations have been theorized to account for sex differences in math achievement, participation, and career choice. Although biological explanations involving genes, hormones, structure and function of the brain, and timing of pubertal changes have been critically reviewed by Petersen (1983), Luchins (1981), and Levine and Ornstein (1983), other investigators are still considering these types of factors; for example, Benbow (1984) recently speculated that increased prenatal testosterone exposure may enhance right hemisphere development, and thus increase mathematical reasoning ability among males. Fennema (in Fennema & Ayer, 1984) has thoroughly reviewed work on sex differences in spatial visualization skills, which in the past, have often been theorized (Sherman, 1980b) to account for differences in math ability. She concluded that if spatial visualization skills do affect the learning of mathematics, the influence must be extremely subtle, and that "...emphasis on the development of spatial visualization skills will probably not do very much to eliminate sex-related differences in mathematics."

Research on affective and socialization variables appears to hold much more promise in explaining sex differences in math ability and achievement. Reyes (1984) wrote an excellent review article on affective variables and math

education. Factors found to be related to achievement include parental expectations (Petersen, 1983; Stage et al., 1985), locus of control or attributional processes (Enemark & Wise, 1981; Parsons, 1983; Wolleat et al., 1980; Shea & Llabre, 1985; Parsons, 1981), math self confidence (Enemark & Wise, 1981; Braggio & Perofski, 1984; Sherman, 1983), stereotyping of mathematics as a male domain (Fox, 1981; Fennema, 1978), beliefs about and expectations of success in math (Wigfield, 1984), perception of math usefulness (Pedro et al., 1981), and sex role considerations (Sherman, 1980c; Schildkamp-Kundiger, 1982; Smead & Chase, 1981; Gripshover, 1984; and Petersen, 1983). Hughes et al. (1985) found that occupational and subject-related stereotypes are well developed in children in the early primary grades. Sherman (1982) found that girls who took four years of theoretical math had more conflict between sex role and achievement than did cognitively equated girls who enrolled in fewer math courses. According to Fennema and Ayer (1984), when young girls feel mathematics is inappropriate for them or their sex roles (not feminine), they will feel anxious about succeeding in math and have more negative attitudes towards it.

In a recent review of the literature, Sheridan and Fizdale (1981) noted that most researchers have found that early in their school careers children learn that mathematics is closely identified with the male role. According to the authors, these stereotypes increase with age and become particularly debilitating for females in math achievement. Boli et al. (1984) found that there is considerable conformity to sex stereotypes among current Stanford undergraduates, with females much less likely to select math-related majors.

According to the findings of many studies, these affective factors, beliefs, values, feelings, and sex role expectations are transmitted by

parents, peers, teachers, and other significant persons in our lives. Although each of these types of socializers is important, we know from the literature on socialization education (Mills, 1985; Beauvais et al., 1986; Maccoby, 1976; Davies & Kandel, 1981; Eccles & Jacobs, 1986; Elmore et al., 1985; Campbell, 1986), that the attitudes of parents clearly have the highest degree of influence in determining our own attitudes as we grow through early childhood, adolescence, and early adulthood--the crucial years for educational and career decisions. Parental attitudes are crucial in determining a young woman's self-concept regarding her abilities, interests, and career goals (Becker, 1984; Wilhelm & Brooks, 1980; Wigfield, 1983; Fox, 1982; Creswell & Houston, 1980). Parents play a particularly important role in transmitting sex-role stereotypes. Boswell and Katz (1980) found that stereotyped beliefs about mathematics are acquired early in the development process and are clearly present in elementary level students. Stereotyped information is transmitted to elementary students by parents, and the degree of stereotyping is predictive of female math achievement. It is clear that by the time we reach school age, teachers, peers, and significant others may also exert influence; however, for most young men and women, parental values, attitudes, beliefs, and expectations remain the single most influential force in their shaping and socialization. Research indicates (Fox, 1977) that parents believe mathematics is a more appropriate activity for males than for females.

Several researchers have also suggested that cultural differences may affect the sex role socialization process (Creswell, 1980; Rothschild & Lichtman, 1980; Johnstone, 1981; and Clarkson & Leder, 1984). Sheridan and Fizdale (1981) noted that reading is closely identified with the female role in North American countries, but that this is not true universally. An intriguing finding from Benbow's research (1984) was that, although boys

generally outnumber girls thirteen to one at the highest level of mathematical reasoning, among Asian American students a much higher proportion of girls scored in the highest ranges. In national comparisons of MSAT scores, both Asian American males and females scored an average of 30 to 33 points higher than Caucasian students (Arbeiter, 1984). West and Gross (1986) found, with course-taking history controlled, a 44 point difference between the average MSAT scores of Caucasian males and females, but only a 27 point difference between Asian American males and females. Gardner et al. (1985) noted that Asian Americans are currently outperforming all other ethnic groups in the educational area. They exhibit the highest rates of high school graduation and a much higher rate of college enrollment (38% vs. 24% for Caucasians, and even lower rates for other ethnic groups). Asian Americans also account for a disproportionately high percentage of enrollment in prestige colleges. Asian American students are overrepresented in gifted programs--i.e., in New York, Asians comprise 1.7 percent of the population and 20 percent of enrollment in gifted programs (Campbell & Connolly, 1984). In studies of students in China, Stanley et al. (1985) found extremely high SATM scores for a selected group of high achieving 13-year-olds. As in studies of Asian American students, boys tended to outscore girls, but the averages were only 16 points apart. Even the lowest scoring Chinese girl scored 77 points above the mean for U.S. girls. Similarly, Husen (1967) found that Japanese 13-year-olds averaged higher scores on a comprehensive mathematics test than did students from any of 11 other countries, including the U.S. Japan also has one of the lowest ratios of male to female math students.

Asian cultures are characterized by close-knit structure, with strong value placed on duty and hard work and providing good models of behavior for children (Sollenberger, 1968). They combine strong parental pressure with

support and discipline. Campbell and Connolly (1984) noted that Asian students in America tend to retain many of the attitudes and values of their former countries. They generally work hard, honor and prestige are very important, and an extremely high value is placed on education. These authors reported that Asian females are more competitive in academic settings. Gardner et al. (1985) also noted that Asian American parents strongly emphasize personal effort--if a child is not doing well in school the typical Caucasian parent blames the teacher or the school, or feels the student just doesn't have the ability. The Asian parent's view is that the student just needs to try harder.

This study was undertaken to determine whether differences in parental expectations and attitudes regarding sex role stereotyping and mathematics do exist between Asian American (hereafter referred to as "Asian") and other American parents (referred to as "non-Asian"). The goal of the study was also to examine the extent to which these expectations and attitudes influence high achieving young persons, specifically with regard to mathematics participation, achievement, and careers. A further purpose of the study was to compare the math achievement, educational goals, career plans, and math-related attitudes of high math-achieving boys and girls and of high and low math-achieving girls.

METHOD

The study was designed to investigate the attitudes and extent of parental influence on three groups of high school students--high math-achieving males, high math-achieving females, and high verbal/low math-achieving females. In the study, these groups are referred to as "high math boys," "high math girls," and "high verbal/low math girls." Differences between Asian students and parents and non-Asian students and parents were also examined.

To complete the study, senior high school students who had taken the SAT during 1985-86 were selected from 22 high schools in five school districts in California and Nevada. Most of the California schools had relatively high Asian student populations. Cooperating school districts included Campbell Union High School District, Mt. Diablo Unified School District, Sacramento City Unified School District, and San Francisco Unified School District in California, and Washoe County School District in Nevada. Student achievement at sample schools was higher, on the average, than that of high school students in general. Of the 17 California high schools represented in the survey, six were rated in the "top 100" based on student scores in a statewide testing--the California Assessment Program (Clancy, 1985). Twelfth graders in these six schools averaged in the 93rd percentile on mathematics tests. Although direct comparisons cannot be made, approximately 94 percent of students who attended the Nevada high schools included in the study passed the Nevada high school Proficiency Examination in mathematics (Nevada Department of Education, 1986). All of the students were selected for the study on the basis of their performance on the Scholastic Aptitude Test (SAT). The high math male and female samples contained students scoring above the 90th percentile on the math subtest of the SAT; the high verbal/low math sample included female students scoring below the 50th percentile on the math subtest but above the 75th percentile on the verbal subtest.

The numbers of students and parents in each group in the study are presented in Table 1. A total of 130 students were included--59 high math boys, 44 high math girls, and 27 high verbal/low math girls. Approximately 23 percent of the students were Asian, and 77 percent were non-Asian. With the exception of two students, the non-Asian group was comprised of 98 Caucasian students. In the study, 131 mothers and 104 fathers of these students were

TABLE 1

COMPOSITION OF STUDY SAMPLE--NUMBER AND PERCENTAGE OF STUDENTS AND PARENTS

GROUPS	STUDENTS		MOTHERS		FATHERS	
	N	%	N	%	N	%
High Math Non-Asian Males	43	33.1%	41	32.8%	36	34.6%
High Math Asian Males	16	12.3%	15	11.5%	11	10.6%
Subtotals:	59		59		47	
High Math Non-Asian Females	33	25.4%	32	24.4%	29	27.9%
High Math Asian Females	11	8.5%	12	9.2%	9	16.3%
Subtotals:	44		44		38	
High Verbal/Low Math Non-Asian Females	24	18.5%	26	19.8%	17	8.7%
High Verbal/Low Math Asian Females	3	2.3%	3	2.3%	2	1.9%
Subtotals:	27		29		19	
TOTALS	130	100%	131	100%	104	100%

also surveyed. It should be noted that parental and student participation in the study was voluntary. The total sample of 365 persons represented response rates of approximately 30 percent for non-Asian respondents and approximately 10 percent for Asian respondents. It should also be noted that not all parents of all students were interviewed; and, conversely, there were three cases where mothers were interviewed, but we were unable to interview their daughters. Since these respondents represented parents from their respective groups, however, they were included in the data pool.

Parallel questionnaires were designed for parents of sons, parents of daughters, and students (see Appendix A). The survey forms were designed to assess mathematics study habits, educational goals, career plans, opinions about math abilities, parental influences, parental attitudes, and sex role characteristics. Copies of the instruments for parents of daughters and for students are attached in Appendix A. Students were given group paper and pencil questionnaires to complete at school and parent interviews were conducted in person.

Questionnaires consisted of original questions plus selected items from the following Fennema-Sherman Mathematics Attitude Scales: Confidence in Learning Mathematics, Mother, Father, Attitude Toward Success in Mathematics, Mathematics as a Male Domain, Usefulness of Mathematics, Mathematics Anxiety, and Effectance Motivation in Mathematics (Fennema & Sherman, 1976). Also included were selected and slightly modified items from the Mathematics Attribution Scale (Fennema et al., 1978), selected items from the Attitudes Toward Women Scale (Spence et al., 1973), selected items from the Need Achievement scale from the Edwards Personal Preference Schedule (Edwards, 1953), and the short form of the Bem Sex-Role Inventory (Bem, 1978).

RESULTS

Student Data

Math/Science Achievement

Data on math and science achievement for sample students is summarized in Table 2. Mean overall grade point averages (GPA's) and math SAT scores were significantly different for the three high and low math groups, although mean verbal SAT scores were quite similar. Mean GPA's were 3.5 for high math boys, 3.6 for high math girls, and 3.0 for high verbal/low math girls. Mean math SAT scores were in the 96th percentile for high math boys and girls and in the 44th percentile for high verbal/low math girls. Even though their percentile scores were similar, high math boys outscored high math girls on the MSAT by 50 points. Mean verbal SAT scores averaged in the 90th percentile for high math males, the 92nd percentile for high math females, and the 87th percentile for high verbal/low math females, who scored slightly lower than both other groups. Both high math males and females had taken an average of four years of mathematics during high school. High math females, however, had taken slightly more advanced placement (AP) courses, as compared with high math males. In contrast, high verbal/low math females had taken significantly fewer math and no AP math courses.

The highest average levels of math achieved by high math boys and girls were typically pre-calculus and trigonometry, whereas algebra II was typically the highest level reached by high verbal/low math girls. The mean math GPA achieved by high math boys and girls was similar (3.4), with a significantly lower mean math GPA for high verbal/low math girls (2.8).

Slight differences existed for the number of science or AP science courses among the three groups. Most students had taken an average of three science courses. All students had enrolled in at least one AP science course, and

TABLE 2

SUMMARY OF STUDENT DATA ON MATH/SCIENCE ACHIEVEMENT

	High Math Boys	High Math Girls	High Verbal/ Low Math Girls
Overall GPA**	3.5	3.6	3.0
Math SAT Score**	702	652	432
Math SAT Percentile	96	96	44
Verbal SAT Score	538	548	502
Verbal SAT Percentile	90	92	87
Years of H.S. Math**	4.0	4.0	3.2
Highest Level of Math Achieved**	5.9	5.6	4.2
# of Honors or A.P. Math Classes**	1.3	1.8	0
Math GPA**	3.4	3.4	2.8
Years of H. S. Science	3.0	3.1	2.7
Highest Level of Science Achieved**	4.4	4.4	3.4
# of Honors or A.P. Science Classes	1.3	1.0	1.3
Science GPA**	3.5	3.6	2.7

** $p < .01$

* $p < .05$

although a number of high verbal girls had enrolled in AP science classes, there were significant differences in the highest levels of science reached by students. The highest levels of science courses achieved by both high math groups were typically chemistry or physics; and zoology or chemistry were typically the highest levels achieved by high verbal/low math girls. The mean science GPA was also significantly higher for high math boys (3.5) and girls (3.6) than for high verbal/low math girls (2.7).

Looking at the data from our sample in terms of ethnicity of students, there were few differences between Asian and non-Asian students in math/-science achievement. However, Asian students tended to take more AP math and more science classes. There were significant differences ($p < .05$) between Asian and non-Asian students on the number of AP science classes taken (Asian - 1.6; non-Asian - 1.1) and the highest level of science achieved (Asian - 4.6; non-Asian - 4.1). While Asian students scored an average of 22 points higher on the MSAT, non-Asians scored significantly higher on the VSAT (544 vs. 500; $p < .05$).

Math Study

Of the total sample, 18.5 percent of the non-Asian students and 33 percent of the Asian students had received some education outside the United States, most frequently during the elementary grades. Almost 95 percent of all students sampled described their high school program as academic or college preparatory. Ninety eight percent of high math males and females were taking or planning to enroll in more math courses than required for graduation; but significantly fewer (74%) high verbal/low math females planned to do so. Most high math students l sted career or college requirements and enjoyment of mathematics as the primary reasons for pursuing further math courses; high verbal/low math students enrolled in additional math courses

because of college of career requirements or because someone else suggested it. Only one low math student took extra math because she enjoyed it.

Most students in our sample had achieved A's and B's in elementary school mathematics. During middle school and junior high school, however, the percentage of A's decreased and the percentage of B's increased for all groups; the number of D's and F's increased for high verbal/low math girls. The majority of high math boys and girls felt their math grades had remained the same from elementary and junior high through high school. A smaller number felt they had improved and very few felt their grades had decreased. Significantly more (70%) high verbal/low math girls, however, indicated that they had lower math grades in high school. These data are summarized in Table 3. There were no differences between Asian and non-Asian students in math grades.

No significant differences between math groups were found in the amount of time spent on homework; however high math females and Asian students spent more time per week than other students. Fifty percent of Asian students sampled reported that they studied eight or more hours per week, but only 33 percent of non-Asians reported spending that much time on homework. Students indicated that their parents helped less with homework in high school as opposed to elementary and junior high school. If they needed help with mathematics homework, high math boys were significantly more likely to receive help from their fathers; high math girls received somewhat more help from their fathers; and high verbal/low math girls received help equally from their fathers and mothers (Table 4). Even in elementary school, most students reported that fathers, rather than mothers, were more likely to help with math. In addition to their studies, students in the sample participated in an average of four extracurricular activities (including part-time jobs) which

TABLE 3

COMPARISON OF MATH GRADES IN
ELEMENTARY AND MIDDLE/HIGH SCHOOL

Group	School Years	Number and Percentage of Students Who Received:*									
		A's		B's		C's		D's		F's	
		N	%	N	%	N	%	N	%	N	%
High Math Boys	Elementary	50	84.7%	9	15.3%	--	--	--	--	--	--
	MS/HS	38	64.4%	19	32.2%	2	3.4%	--	--	--	--
High Math Girls	Elementary	40	90.9%	2	4.5%	2	4.5%	--	--	--	--
	MS/HS	37	84.1%	5	11.4%	2	4.5%	--	--	--	--
High Verbal/ Low Math Girls	Elementary	18	66.7%	6	22.2%	3	11.1%	--	--	--	--
	MS/HS	13	48.1%	9	33.3%	3	11.1%	1	3.7%	1	3.7%

	Number and Percentage of Students Who Felt Their Math Grades Had:**					
	Stayed the Same		Increased		Decreased	
	N	%	N	%	N	%
High Math Boys	28	48.3%	22	37.9%	8	13.8%
High Math Girls	28	63.6%	11	25.0%	5	11.4%
High Verbal/Low Math Girls	5	18.5%	3	11.1%	19	70.4%

* Chi Square Significance Level: $p < .05$
** Chi Square Significance Level: $p < .01$

TABLE 4

WHO HELPS WITH MATH HOMEWORK

	Number and Percentage of Students Who Received Help From:**					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Mother	2	3.4%	8	18.6%	4	14.8%
Father	27	45.8%	12	27.9%	4	14.8%
Both Equally	5	8.5%	1	2.3%	8	29.6%
Neither Parent	21	35.6%	17	39.5%	10	37.0%
Never Need Help	4	6.8%	5	11.6%	1	3.7%

** Chi Square Significance Level: $p < .01$

required an average of 11-15 hours per week. Although there were no significant differences between groups, high verbal females tended to participate in slightly more activities than did students in either of the high math groups.

Educational Plans

Almost all students felt that getting a good education was very important. Approximately 90 percent of sample students were planning to attend a four-year college, with the remaining 10 percent planning to attend a two-year college or vocational school. Data on educational aspirations are summarized in Table 5. A majority of our sample of students expected to obtain an advanced degree (M.A., Ph.D., M.D.); however, high math girls were most undecided about their educational goals. Most high math boys and girls were confident that they would achieve their educational goals, whereas a lower percentage of high verbal/low math girls were as confident about reaching their goals. The percentage of students who were "sure" or "very sure" of reaching their educational goals were: high math boys--89.9 percent; high math girls--83.8 percent; and high verbal/low math girls--66.6 percent.

As expected, there were significant differences ($p < .01$) between groups of students on their choices of college majors (Table 6). A large number of high math boys chose majors in engineering, science, and mathematics; a smaller number of high math girls, and an even smaller number of high verbal/low math girls chose these majors. Many high math girls also intended to major in medicine or law; high verbal/low math girls most frequently planned to pursue business and life science majors. High math girls were also the most undecided about which majors they intended to pursue. Significant differences ($p < .05$) were also found between Asian and non-Asian students in choices of college majors. Asian students most frequently chose science, engineering, art, music, medicine, and law. Non-Asian students most frequently chose majors in engineering, business, and science.

TABLE 5

HIGHEST LEVEL OF EDUCATION TO BE COMPLETED

	Number and Percentage of Students Who Listed Each Level:**					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Two-Year Degree	0	--	0	--	2	7.4%
BA/BS	12	20.3%	2	11.1%	4	14.8%
Advanced Degree	45	76.3%	31	70.4%	18	66.6%
Undecided	2	3.4%	11	25.0%	3	11.1%

** Chi Square Significance Level: $p < .01$

TABLE 6

EXPECTED COLLEGE MAJORS

	Number and Percentage of Students Who Selected Each Major:**					
	High Math Boys		High Math Girls		High Verbal/Low Math Girls[1]	
	N	%	N	%	N	%
Engineering, Science, Math	35	62.5%	16	36.4%	5	19.2%
Business	4	7.1%	6	13.6%	7	26.9%
Social Science	0	--	1	2.3%	4	15.4%
Teaching	3	5.4%	0	--	2	7.7%
Art/Music	4	7.1%	2	4.5%	2	7.7%
Humanities/ Liberal Arts	9	16.1%	5	11.3%	4	15.5%
Other Majors[2]	0	--	9	20.5%	1	3.8%
Undecided	1	1.8%	5	11.4%	1	3.8%

[1]This group chose no math or engineering majors; most of their science majors were in the life sciences such as biology or botany.

[2]Includes pre-med and law.

** Chi Square Significance Level: $p < .01$

Career Plans

All high math females, 98 percent of high math males, and 92 percent of high verbal/low math females anticipated having full-time careers in the future. Significant differences ($p < .01$) were found in career choices of the three groups of students. High math males and females chose mathematics, engineering, and physical sciences, which are highly math-related, traditionally masculine careers. Most high verbal/low math females chose business or less math-related careers. When they did choose math or science, they picked teaching math and life sciences, which are both more traditionally feminine areas. Again, high math females were, as a group, the most undecided about career goals--27.3 percent of high math girls were uncertain about future careers, whereas 18.6 percent of high math boys and only 3.7 percent of high verbal girls were undecided.

Information on career choices for each of the three math groups is summarized in Table 7. Traditionality of career choices was estimated using 1980 census data (U. S. Department of Labor, 1985) on the percentage of U.S. females in each occupation. High verbal/low math girls chose careers which were more traditionally female than did high math girls. Prestige ratings for careers were made using Siegel's NORC Prestige Scale (cited in Lin, 1976). Careers chosen by females were higher in average prestige than were careers chosen by males, but differences were very slight. Math relatedness of careers was determined using a scale developed for the project. The scale was based on information from a math and careers poster (Saunders, 1981) and from Purdue University math requirements for admission and graduation degree programs (Matyas, 1985) for careers. The scale ranged from 1, for those occupations requiring only basic math, to 4, for those occupations requiring algebra II or higher. A sample of scaled occupations is attached in Appendix B. High

TABLE 7

SUMMARY OF AVERAGE TRADITIONALITY, PRESTIGE, AND MATH-RELATEDNESS OF CAREER CHOICES

	High Math Boys	High Math Girls	High Verbal/ Low Math Girls
Traditionality[1]	25.0%	27.2%	35.5%
Prestige[2]	84.5	87.7	88.9
Math-Relatedness[3]	2.7	2.5	2.2

[1]Average percentage of females in the U. S. work force in occupations selected by each group.

[2]Average prestige rating (NORC Prestige Scale) for careers selected by each group.

[3]Based on a 4-point scale developed for the study. 1 = Basic math required; 2 = Algebra I required; 3 = Geometry required; 4 = Algebra II, Trig or higher math required. (See Appendix B for a copy of the scale.)

math males chose the most highly math-related careers, and high verbal/low math females chose careers which were less math related.

Most high math males (62.1%) and high verbal/low math females (53.8%) were confident they would meet their career goals. High math females, however, were significantly ($p < .01$) less confident of meeting their career expectations (see Table 8). Only 21.6 percent of high math females were sure or very sure of reaching career goals, whereas 32.4 percent were unsure or very unsure.

When given a list of 20 career choices and asked to indicate their most and least preferred, high math males and females chose traditionally masculine (low percentage female), very prestigious, and moderately high math-related occupations. Conversely, high verbal/low math females chose more traditionally feminine, slightly less prestigious, and less math-related careers. The careers least likely to be pursued by high math males were more traditionally feminine, lower in prestige and lower in math relatedness. Similar choices were made for high math and high verbal/low math females, but the contrasts with their preferred choices were not as drastic. When asked to select the careers they would prefer if they were members of the opposite sex, high math males and high verbal/low math females chose occupations more traditionally characteristic of the opposite sex. High math females, however, continued to choose occupations consistent with their previous choices. These data are summarized in Table 9.

A high percentage of high verbal/low math females (88.9%), slightly fewer high math females (81.8%), and significantly ($p < .05$) fewer high math males (65.5%) anticipated a time in their lives when it would be preferable to have a part-time career or none at all. Taking time to have a family was the primary reason given by females, with pursuit of other interests and leisure activities given as the primary reason by males.

TABLE 8

CERTAINTY OF REACHING CAREER GOALS

	Number and Percentage of Each Group Who Were:**					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Sure or Very Sure	36	62.1%	8	21.6%	14	53.8%
Pretty Sure	14	24.1%	17	45.9%	7	26.9%
Unsure or Very Unsure	8	13.8%	12	32.4%	5	19.2%

** Chi Square Significance Level: $p < .01$

TABLE 9

CAREER CHOICES SELECTED FROM A FIXED LIST OF 20 OCCUPATIONS[1]

	High Math Boys	High Math Girls	High Verbal/ Low Math Girls
Traditionality[2]:			
Average of top 3 career choices	31.8%	31.0%	41.5%
Average of 3 least preferred careers	68.0%	65.5%	69.5%
Average of top 3 career choices if opposite sex	41.9%	33.8%	32.4%
Prestige[3]:			
Average of top 3 career choices	89.4	89.1	85.2
Average of 3 least preferred careers	65.4	68.8	65.0
Average of top 3 career choices if opposite sex	84.8	89.1	88.5
Math-Relatedness[4]:			
Average of top 3 career choices	2.8	2.5	2.0
Average of 3 least preferred careers	1.6	1.9	1.6
Average of top 3 career choices if opposite sex	2.5	2.6	2.2

[1]See survey form questions 25-27 for the list of occupations.

[2]Average percentage of females in the U.S. work force in occupations selected by each group.

[3]Average prestige rating (NORC Prestige Scale) for careers selected by each group.

[4]Based on a 4-point scale developed for the study. 1 = Basic math required; 2 = Algebra I required; 3 = Geometry required; 4 = Algebra II, Trig or higher math required. (See Appendix B for a copy of the scale.)

If working were not a financial necessity, the majority of female students would still continue a career to provide a challenge and purpose to life. Male students would be less likely to continue working. The majority of students did not anticipate that marriage and having a family would interrupt their career ambitions, although there were significant differences ($p < .01$) among plans of the three groups (Table 10). A small percentage of high math females and a slightly larger percentage of high verbal/low math females planned to discontinue working after having children. When asked about the relative importance of family and career, most students (74-91%) felt that both a family and a career were equally important to them. They also felt that both parents placed similar importance on both career and family. No significant differences in career and family plans were found between Asian and non-Asian students.

Perceived Aptitudes and Abilities

Popularity - Large, statistically significant ($p < .01$) differences among student groups were found on self-perceived popularity. These data are summarized in Table 11. Compared with students of the same sex at their school, most high math males felt they were equally (33.9%) or more popular (37.3%). Almost half of the high math females (47.7%) felt they were less popular than other students; whereas the majority of high verbal/low math females (85.2%) considered themselves more popular than their schoolmates.

Math Ability - Statistically significant differences ($p < .01$) were found in students' self-perceived math ability (Table 12). Most (71.2%) high math males felt their math ability was much higher than other students. High math females, however, typically (59.1%) rated their math ability only somewhat higher than other students; and high verbal/low math students typically

TABLE 10

FUTURE PLANS REGARDING CAREER AND FAMILY

	Number and Percentage of Students Who Reported They Would Probably:**					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Stop working when I get married	2	3.4%	0	--	0	--
Marry and continue working until I have children	0	--	4	9.3%	5	18.5%
Marry and continue working	21	35.6%	4	9.3%	2	7.4%
Marry, have children, and continue working	32	54.2%	34	79.1%	19	70.4%
Have a career and never marry	4	6.8%	1	2.3%	1	3.7%

** Chi Square significance level: $p < .01$

TABLE 11

SELF-RATINGS OF STUDENT POPULARITY
AS COMPARED WITH OTHER STUDENTS IN THEIR CLASSES

	Number and Percentage of Students Who Felt They Were:**					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Much more popular	2	3.4%	0	--	0	--
Somewhat more popular	20	33.9%	4	9.1%	23	85.2%
Neither more nor less popular	27	45.8%	19	43.2%	3	11.1%
Somewhat less popular	10	16.9%	21	47.7%	1	3.7%

** Chi Square Significance Level: $p < .01$

TABLE 12

SELF-RATINGS OF MATH ABILITY AND ACHIEVEMENT
AS COMPARED WITH OTHER STUDENTS

	Number and Percentage of Students Who Felt Their Math Ability Was:**					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Much Higher	42	71.2%	14	31.8%	6	22.2%
Somewhat Higher	13	22.0%	26	59.1%	6	22.2%
About the Same	4	6.8%	1	2.3%	11	40.7%
Somewhat Lower	0	--	0	--	4	14.8%
Much Lower	0	--	3	6.8%	0	--

	Number and Percentage of Students Who Felt Their Math Achievement Was:**					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Much Higher	31	52.5%	12	27.3%	5	18.5%
Somewhat Higher	25	42.4%	27	61.4%	5	18.5%
About the Same	2	3.4%	3	6.8%	15	55.6%
Somewhat Lower	0	--	0	--	1	3.7%
Much Lower	1	1.7%	2	4.5%	1	3.7%

** Chi Square Significance Level: $p < .01$

(40.7%) felt their math ability was about the same as other students. Most high math males felt that their math ability had been consistent over the years, but females felt that their math ability had improved (in the case of the high math females) or worsened (in the case of the high verbal/low math females). On the average, male students realized their math ability at age 10 or 11, and females realized their math ability at age 12 or 13. The majority of students from all three groups agreed that their current math ability could be improved. Over half of the high math males and females felt that additional studying would improve their abilities, whereas high verbal/low math females were more likely to feel that better teaching would be most effective in improving their math ability. Over all math groups, Asian students consistently listed more studying as the single most important factor that would improve their ability.

Math Achievement - All three groups of students generally rated their math achievement in the same way they had rated their math ability as compared with other students (Table 12). When comparing their current achievement to past achievement, however, almost three quarters of males in the sample felt their math achievement had remained the same, whereas the majority of females (40.9% of high math and 51.9% of high verbal/low math) felt their achievement level had changed.

Mathematics Attitude - Data on students' feelings toward math are presented in Table 13. Statistically significant differences were found between math groups. Most high math males (53.7%) stated that they liked math very much. High math females also liked math very much (34.9%) or thought that math was "all right" (37.2%). High verbal/low math females, however, felt that math was all right (44.4%) or disliked math (22.2%). Asian students were significantly ($p < .05$) more likely to think math was "all right," and non-Asians were more likely to report liking math very much. These attitudes

TABLE 13

ATTITUDE TOWARD MATH

	Number and Percentage of Students Who Reported They:*					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Like math very much	29	53.7%	15	34.9%	3	11.1%
Feel math is all right	20	37.0%	16	37.2%	12	44.4%
Neither like nor dislike math	2	3.7%	2	4.7%	5	18.5%
Don't like math	2	3.7%	7	16.3%	6	22.2%
Really dislike math	1	1.9%	3	7.0%	1	3.7%

* Chi Square Significance Level: $p < .05$

toward math were reported to have been consistent since elementary school for high math males. High math and high verbal/low math females, in contrast, reported that their math attitudes had previously been different, and usually reported that they had liked math better in the past. The majority of high math males (72.9%) and high verbal/low math females (63.0%) did not feel their math attitudes could be improved. High math females did feel their math attitudes could be improved with better teachers, if math became easier, or if they found math to be more useful and relevant.

Parental Influence

Data on the extent of student-perceived parental influence on high school studies and career plans are summarized in Table 14. No significant differences in the extent of mothers' influence on high school class choices were found when comparing the three math groups; however, there were differences ($p < .05$) in the extent of fathers' influence on class choices. High math girls acknowledged much greater influence from fathers than did other groups. In the area of career choice, students differed on the extent of both mothers' and fathers' influence ($p < .05$). More high math girls reported a great deal of influence from their mothers than did other groups. Approximately 20 percent of both high math boys and girls reported a great deal of influence from their fathers, but high verbal/low math girls reported a much lower degree of parental influence on their career choices. Summarizing these findings on career choice, high math boys were more influenced by their fathers than their mothers, high math girls reported being influenced by both parents, and high verbal/low math girls reported very little influence from either parent.

Significant differences ($p < .05$) in parents' influence on career choice were also found between Asian and non-Asian students. Asian students reported

TABLE 14

EXTENT OF STUDENT-PERCEIVED PARENTAL INFLUENCE ON
HIGH SCHOOL STUDIES AND CAREER PLANS

	Number and Percentage of Students Who Reported Each Level of Influence From:											
	High Math Boys				High Math Girls				High Verbal/ Low Math Girls			
Influence on Choice of High School Classes:	Mother		Father*		Mother		Father*		Mother		Father*	
	N	%	N	%	N	%	N	%	N	%	N	%
No Influence	14	23.7%	18	30.5%	8	18.6%	6	14.3%	4	16.7%	10	37.0%
Not Very Much/Slight Influence	34	57.6%	29	49.2%	22	51.2%	23	54.8%	13	54.2%	15	55.5%
A Fair Amount of Influence	8	13.6%	7	11.9%	6	14.0%	4	9.5%	4	16.7%	0	--
A Great Deal of Influence	3	5.1%	5	8.5%	7	16.3%	9	21.4%	3	12.5%	2	7.4%
Influence on Career Plans:	Mother*		Father*		Mother*		Father*		Mother*		Father*	
	N	%	N	%	N	%	N	%	N	%	N	%
No Influence	21	35.6%	16	27.6%	8	18.2%	11	25.6%	8	34.8%	11	42.3%
Not Very Much/Slight Influence	27	55.7%	20	34.4%	23	52.3%	19	44.2%	14	60.9%	13	50.0%
A Fair Amount of Influence	10	16.9%	11	19.0%	6	13.6%	4	9.3%	0	--	1	3.8%
A Great Deal of Influence	1	1.7%	11	19.0%	7	15.9%	9	20.9%	1	4.3%	1	3.8%

* Chi Square Level of Significance: $p < .05$

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being less influenced by their mothers and more influenced by their fathers, as compared with non-Asian students.

According to students, to influence their children, mothers were most likely to discuss the child's abilities, the merits of various careers, and their own desires for their children's futures. Fathers exerted influence by discussing the merits of careers and the child's abilities. High math males (18.6%) and females (31.4%) also reported that their fathers influenced their career choices by setting an example; however, no high verbal females reported being influenced in this way by their fathers.

As reported by students, parents also influenced their children's career plans by participating in a number of activities. For females, parental influence was greatest with respect to verbal skills (reading, word puzzles, library, etc.). In contrast, high math boys reported the greatest percentage of parents providing mathematical and scientific toys. Parents of high math girls were most likely to have provided a home computer. These data are summarized in Table 15.

When patterns of individual parent participation in each of the mathematics-related activities were analyzed, both high math groups reported more participation by their fathers; high verbal females reported relatively more participation by their mothers. All groups reported more participation by their mothers in verbal activities. There were no significant differences in Asian and non-Asian students' perceptions of the amount of parental participation in educational activities.

Aside from their parents, few people were reported to have strongly influenced high math boys and girls (Table 16). A teacher or counselor was listed as the strongest additional influencer for all of the students, and a sibling or other relative was also mentioned by 11 to 15 percent of students.

TABLE 15

EDUCATIONAL ACTIVITIES CARRIED OUT BY PARENTS

	Number and Percentage of Students Who Reported Each Activity by Parents:						
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls		Significance Level
Activities Carried Out With the Child	N	%	N	%	N	%	
Encouraged reading	49	83.1%	39	88.6%	25	92.6%	n.s.
Took to library	44	74.6%	41	93.2%	25	92.6%	n.s.
Provided childrens' books	49	83.1%	43	97.7%	22	81.5%	n.s.
Played word puzzles	34	57.6%	32	72.7%	22	81.5%	n.s.
Played strategy games	38	64.4%	32	72.7%	19	70.4%	n.s.
Played card games	46	78.0%	34	77.3%	20	74.1%	n.s.
Taught to build things	41	69.5%	29	65.9%	18	66.7%	n.s.
Taught to make change	36	61.0%	31	70.5%	22	81.5%	n.s.
Taught to tell time	37	62.7%	36	81.8%	14	51.9%	*
Provided educational toys	47	79.6%	41	93.2%	24	88.9%	n.s.
Provided math or science toys	40	67.8%	24	54.5%	12	44.4%	.06
Played number games	27	45.8%	34	77.3%	21	77.8%	*
Taught to work math problems	34	57.6%	32	72.7%	19	70.4%	.08
Provided a home computer	23	39.0%	26	59.1%	4	14.8%	*
Taught to program a computer	8	13.6%	10	22.7%	8	29.6%	n.s.

* Chi Square Significance Level: $p < .05$

TABLE 16

OTHER PERSONS BESIDES PARENTS WHO INFLUENCED STUDENTS' CAREER PLANS

	Number and Percentage of Students Who Were Strongly Influenced by a:*					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Teacher or Counselor	19	32.2%	10	22.7%	8	29.6%
Sibling or Relative	9	15.2%	6	13.6%	3	11.1%
Famous Person	0	--	3	6.8%	5	18.5%
Friend	5	8.5%	1	2.3%	4	14.8%
Other Person	0	--	1	2.3%	1	3.7%
No Other Person	26	44.1%	23	52.3%	6	22.2%

* Chi Square Significance Level: $p < .05$

Other important influencers for high verbal/low math girls were friends or famous people.

Math-Related Attitudes

As part of the questionnaire, students were given a number of math attitude scales. Brief descriptions of each scale, along with major findings, are presented below. Analyses of variance were carried out on these data; means and significance levels of F statistics from analysis of the 13 scales are presented in Table 17.

Math Usefulness - This scale consisted of the 12-item Fennema-Sherman Mathematics Attitude Scale (F-S MAS) (Fennema & Sherman, 1976), which measures how students perceive the usefulness of math for themselves and their futures, plus one additional item on the usefulness of math for persons of the opposite sex. All students felt that math was very useful for themselves and their futures; however the usefulness ratings of high verbal/low math females were slightly lower than those of the other two groups. When the one additional item on usefulness for persons of the opposite sex was analyzed, significantly fewer males felt that math was useful for women.

Math as a Male Domain - This 12-item F-S MAS scale assessed the degree to which mathematics is stereotyped as a subject more appropriate for males. Significantly ($p < .01$) more male students were in agreement that math is a "male domain;" both groups of female students felt that math is as appropriate for women as for men.

Enjoyment of Math - As expected, high math students enjoyed math and mathematics-related activities significantly more ($p < .05$) than did high verbal students. The scale consisted of four original items.

Effectance Motivation in Math - This scale evaluated the extent to which students felt challenged and motivated by mathematics, and was composed of six

TABLE 17

MEANS AND SIGNIFICANCE LEVELS OF F FOR
STUDENTS' SCORES ON MATHEMATICS ATTITUDE SCALES

Scale	High Math Boys	High Math Girls	High Verbal/ Low Math Girls	Maximum Possible Score	Significance Level of F
Math Usefulness	50.0	51.0	47.3	65	n.s.
Math as a Male Domain[1]	49.4	55.7	55.3	60	**
Enjoyment of Math	14.5	13.6	11.9	20	*
Effectance Motivation	21.3	21.7	19.1	30	n.s.
Math Anxiety[2]	8.2	7.7	5.6	10	**
Math Confidence	25.8	25.1	21.8	30	*
Attitudes Toward Success in Math	27.6	30.4	27.7	35	**
Peer Attitudes Regarding Math	25.8	28.6	28.8	40	**
Need Achievement	26.5	26.3	27.4	30	n.s.
Attitudes Toward Women[3]	33.1	36.5	36.1	40	**
Parents' Traditional Attitudes	16.4	16.3	15.9	20	n.s.
Father's Attitude	29.4	31.3	29.3	35	n.s.
Mother's Attitude	30.5	30.3	26.3	35	*

[1] A high score indicates absence of stereotyping.

[2] A high score indicates absence of anxiety.

[3] A high score indicates nontraditional attitudes.

* $p < .05$
** $p < .01$

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items selected from the F-S MAS. Differences in average scores for the three groups were not statistically significant, although high verbal females reported the lowest "math motivation."

Math Anxiety - The degree of anxiety experienced by students while performing or thinking of math was assessed by this brief scale, which included two items selected from the F-S MAS. High math males and females experienced the least amount of anxiety with regard to math, and high verbal females reported feeling significantly higher math anxiety.

Math Confidence - Again, high math males and females reported significantly ($p < .05$) higher levels of confidence in their mathematical abilities as compared with high verbal females. The scale consisted of six items selected from the F-S MAS.

Attitudes Toward Success in Math - The items in this scale (seven items from the F-S MAS) were designed to measure the students' desire to succeed in math and how this desire is inhibited by their peers' attitudes. High math girls reported significantly ($p < .01$) greater desire to succeed in mathematics in spite of peer attitudes; high math boys and high verbal girls were not as eager to succeed in math and were more inhibited by peer attitudes.

Peer Attitudes Regarding Math - This original eight-item scale measured the students' perceptions of how success in math, and school in general, are regarded by peers, and the effect on the students' popularity. High math and high verbal females were significantly ($p < .01$) less inclined to believe that their peers looked down on students who were successful in math, whereas high math males were in agreement that peers do look down on students who are successful in math. Non-Asian students were also significantly ($p < .05$) more likely than Asian students to believe that peers look down on successful math students.

Need Achievement - This six-item scale (from Edwards, 1953), assessed competitive nature and desire for great accomplishment and success in life. No differences were found among the three student groups. All students desired to do well in life and had very high need achievement scores.

Attitudes Toward Women - This scale measured traditionality of attitudes toward women, and included eight items from Spence's (1973) scale. Significant differences (p .01) by sex were found; female students had the least traditional attitudes, whereas male students expressed more traditional attitudes; i.e. "a woman's place is in the home."

Parents' Traditional Attitudes - This original four-item scale appraised the students' perception of how traditional their mothers' and fathers' attitudes were toward independence and male/female roles with respect to their son or daughter. No significant differences were noted on this scale for student groups. Although Asian parents were perceived as more traditional.

Father's and Mother's Attitude - These F-S MAS items measured the students' perceptions of how their mothers and fathers rated the students' abilities in mathematics, the importance of education, and the importance and usefulness of mathematics. High math boys and girls perceived their mothers as placing great importance on education and mathematics and regarding their sons and daughters as capable math learners. High verbal girls, however, perceived their mothers as placing importance on education and mathematics, and considering their daughters to be less capable of learning math. In contrast, the fathers of all groups were perceived to place a high importance on mathematics education and to have confidence in their childrens' math abilities.

Math Attributions - These scales, selected from the Fennema Math Attribution Scale (Fennema, 1978), allowed the student to estimate the extent to which the environment, the task, their effort, or their ability contribute to their success or failure in math. In the items, "environment" is described as teachers, other students, etc.; "task" is the difficulty or easiness of mathematics; "effort" is the amount of study and work done by the student; and "ability" is the natural ability of the student. Data on attributions are summarized in Table 18. All students attributed failure in mathematics primarily to a lack of effort and the difficulty of math. Significant differences ($p < .05$) were found for the attribution of "ability" as a reason for failure or success. High math males and females strongly felt that lack of ability was not the reason for failure in math, and that success was due to ability. High verbal females were more likely to attribute failure to lack of ability and less likely to attribute success to ability than either of the high math groups. All groups also attributed success to environment.

Bem Sex-Role Inventory (BSRI)

Students were also given the short form of the BSRI (Bem, 1978), which consists of 30 personality characteristics on which they are asked to rate themselves on a scale from 1 (never true of me) to 7 (always true of me). The items include traits which have been traditionally viewed as "masculine," "feminine," or "neutral." For example, "masculine" traits generally describe a strong, risk-taking, independent personality; "feminine" traits generally describe a nurturing, sensitive personality. On the basis of their responses to these items, students were classified as "masculine," "feminine," "androgynous," or "undifferentiated." "Androgynous" was defined as rating high on both masculine and feminine traits, and "undifferentiated" was defined as

TABLE 18

STUDENT ATTRIBUTIONS FOR SUCCESS AND FAILURE
IN MATHEMATICS

	High Math Boys	High Math Girls	High Verbal/ Low Math Girls	Significance of F
Attributions for Success				
Environment	8.8	9.2	8.7	n.s.
Task	7.0	7.3	7.6	n.s.
Effort	7.2	7.7	7.8	n.s.
Ability	7.6	7.0	6.2	**
Attributions for Failure				
Environment	6.5	6.4	6.6	n.s.
Task	7.0	7.6	7.3	n.s.
Effort	7.9	9.5	7.6	n.s.
Ability	4.9	5.2	6.1	*

* $p < .05$

** $p < .01$

being neither strongly masculine nor feminine. There were significant differences ($p < .01$) in the ways students classified themselves on the BSRI (Table 19). The highest percentage of high math boys classified themselves as undifferentiated, with the second highest percentage classifying themselves as masculine. The highest percentages of both high math and high verbal females, however, classified themselves as androgynous, with the second highest classification being masculine for high math females and undifferentiated for high verbal females. Scores on the BSRI masculinity and femininity scales are also summarized in Table 19. Female students rated themselves significantly ($p < .05$) higher on both scales than did males.

Why Women Don't Choose Math/Science Careers

High math males generally believed that social pressure, lack of interest, and lack of encouragement from parents are the primary reasons that women do not pursue careers in math and science. High math females believed that fear of lack of acceptance, social pressure, lack of parental encouragement, and the difficulty of math are the reasons few women pursue math and science careers. In contrast, high verbal females listed lack of interest, fear of math, and lack of parental encouragement as the main reasons why women do not pursue careers in math and science.

Parent Data

Demographic Data on Parents

The total sample of 235 parents (see Table 1) consisted of 78 percent Caucasian, 21 percent Asian, one percent Native American, one percent Black, and one percent Hispanic persons. Median ages were mothers--44, and fathers--46.

TABLE 19

BEM SEX ROLE INVENTORY SCORES

	High Math Boys	High Math Girls	High Verbal/ Low Math Girls	Significance of F
"Masculine" Score	45.5	50.1	49.8	*
"Feminine" Score	48.3	54.0	52.5	*

Numbers and Percentages of Students Who Classified Themselves As:**

	High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%
Masculine	16	27.1%	11	25.0%	3	11.1%
Feminine	11	18.6%	8	18.2%	1	3.7%
Androgynous	8	13.6%	15	34.1%	16	59.3%
Undifferentiated	24	40.7%	10	22.7%	7	25.9%

* $p < .05$

** Chi Square Level of Significance: $p < .01$

Eighty percent of parents were U.S. born, with 15 percent born in Asia, three percent born in Europe, and two percent born in other countries, including Canada and Mexico; 85 percent of all parents listed English as their preferred language. Other languages included Chinese, Japanese, Russian, and Spanish. Sixty two percent of Asian parents and 11 percent of non-Asian parents had attended school outside the U.S.

Almost all of the fathers in the sample (96%) were married; but only 84 percent of the mothers were currently married, with 13 percent divorced or separated. Mothers of high math/low verbal girls were more likely to be divorced than mothers of any other groups.

The majority of parents in the sample (almost 80% of fathers and 56% of mothers) had earned at least a Bachelor's degree (Table 20). Of the three math groups, parents of high math girls were most likely to have earned advanced degrees, and parents of high verbal/low math girls were least likely to have advanced degrees. Across all groups, fathers had achieved higher educational levels than had mothers; i.e., 23 percent of fathers and only four percent of mothers had received Ph.D.'s. Fewer Asian parents had earned advanced degrees and Asian mothers were significantly less likely to have attained higher educational levels (Table 21).

Information on current and previous employment status of parents is presented in Table 22. Ninety five percent of fathers and 58 percent of mothers in the sample were currently employed full-time, 26 percent of mothers were working part-time, and 12 percent were not employed outside the home. During the time their children were growing up, 70 percent of mothers of high math girls worked full-time or part-time; the majority of mothers of high math boys and high verbal/low math girls (55%) reported that they had stayed at home. This difference approached statistical significance.

TABLE 20

EDUCATIONAL LEVEL OF SAMPLE PARENTS OF EACH STUDENT MATH GROUP

Highest Degree Received	Number and Percentage of Parents Who Had Received Each Degree:											
	Fathers						Mothers					
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls		High Math Boys		High Math Girls		High Verbal/ Low Math Girls	
	N	%	N	%	N	%	N	%	N	%	N	%
No Degree	1	2.1%	2	5.3%	1	5.3%	6	10.3%	5	11.4%	3	10.3%
High School	9	19.1%	0	--	4	21.1%	15	25.9%	8	18.2%	10	34.5%
Junior College	3	6.4%	0	--	2	10.5%	8	13.8%	0	--	3	10.3%
B.S. or B.A.	15	31.9%	16	42.1%	8	42.1%	20	34.5%	17	38.6%	10	34.5%
M.S. or M.A.	8	17.0%	8	21.1%	3	15.8%	8	13.8%	10	22.7%	3	10.3%
Ph.D. or other Advanced	11	23.4%	12	31.6%	1	5.3%	1	1.7%	4	9.1%	0	--

TABLE 21

EDUCATIONAL LEVEL OF SAMPLE PARENTS BY ETHNICITY

Highest Degree Received	Number and Percentage of Parents Who Had Received Each Degree:							
	Fathers				Mothers*			
	Asian		Non-Asian		Asian		Non-Asian	
	N	%	N	%	N	%	N	%
No Degree	2	9.1%	2	2.4%	8	26.7%	6	5.9%
High School	4	18.2%	9	11.0%	9	30.0%	24	23.8%
Junior College	3	13.6%	2	2.4%	2	6.7%	9	8.9%
B.S. or B.A.	6	27.3%	33	40.2%	9	30.0%	38	37.6%
M.A. or M.A.	3	13.6%	16	19.5%	1	3.3%	20	19.8%
Ph.D. or other Advanced	4	18 2%	20	24.4%	1	3.3%	4	4.0%

* Chi Square Significance Level: $p < .01$

TABLE 22

CURRENT AND PREVIOUS EMPLOYMENT STATUS OF PARENTS

	Number and Percentage of Parents of Each Student Math Group With Each Employment Status:															
	Fathers								Mothers							
	High Math Boys		High Math Girls		High Verbal/ Low Math Girls		Totals		High Math Boys		High Math Girls		High Verbal/ Low Math Girls		Totals	
Current Employment Status	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Employed Full Time	45	95.7%	36	94.7%	18	94.7%	99	95.2%	30	51.7%	27	61.4%	19	65.5%	76	58.0%
Employed Part Time	2	4.3%	1	2.6%	0	--	3	2.9%	19	32.8%	8	18.2%	7	24.1%	34	26.0%
Unemployed, Ill, Retired, or Disabled	0	--	1	2.6%	1	5.3%	2	1.9%	3	5.2%	2	4.5%	0	--	5	3.8%
Not Employed Outside the Home (Homemaker)	0	--	0	--	0	--	0	--	6	10.5%	7	15.9%	3	10.3%	16	12.2%
Employment Status When Child Was Growing Up																
Worked or Attended School Full Time	46	97.9%	33	86.8%	18	94.7%	97	93.3%	14	24.1%	16	36.4%	9	31.0%	39	29.8%
Worked or Attended School Part Time	1	2.1%	4	10.5%	1	5.3%	6	5.8%	12	20.7%	15	34.1%	4	13.8%	31	23.7%
Full Time Homemaker	0	--	1	2.6%	0	--	1	1.0%	32	55.2%	13	29.5%	16	55.2%	61	46.6%

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Data on the traditionality, prestige, and math-relatedness of parents' occupations are shown in Table 23. The majority of fathers in the sample were in traditionally male-oriented occupations (with an average of 26.8% females in these occupations) that were highly prestigious (average of 78.4 on the NORC Scale). Fathers of high math daughters tended to hold jobs which were more highly related to math (with an average of 2.8 on a 4-point scale) than those of any other group. Mothers who worked full-time or part-time were in moderately traditional female occupations (averaging 64.2% female employees) that were not as prestigious (average 68.4) and not as math related (average 1.6) as those of fathers. As compared with mothers of other groups, mothers of high math girls held less traditional, more prestigious, and more highly math-related jobs. In general, the occupations of Asian parents were less prestigious than those of non-Asians.

Twenty five percent of fathers in the sample and over half of mothers (51%) had enrolled in a university or college during the past few years. Mothers of high math daughters were the group with the highest percentage (61.4%) of college enrollment. Significantly more non-Asian fathers ($p < .05$) and non-Asian mothers ($p < .01$) had recently enrolled in college.

There were no differences in family income by student math groups as reported by fathers in the sample, with median income levels at $50,000-$60,000 for each of the three groups. When mothers were asked about income, however, mothers of high verbal/low math girls reported slightly lower family incomes, with a median of $45,000-$50,000. Asian families in the sample reported significantly ($p < .01$) lower family incomes, with a median of $40,000-$45,000.

TABLE 23

AVERAGE TRADITIONALITY, PRESTIGE, AND MATH-RELATEDNESS OF PARENTS' CURRENT OCCUPATIONS

	Fathers				Mothers[4]			
	High Math Boys	High Math Girls	High Verbal/ Low Math Girls	Average	High Math Boys	High Math Girls	High Verbal/ Low Math Girls	Average
Traditionality[1]	28.2%	23.8%	29.6%	26.8%	66.6%	55.8%	71.3%	64.2%
Prestige[2]	71.5	85.3	82.4	78.4	63.8	76.3	66.4	68.4
Math-Relatedness[3]	2.1	2.8	2.4	2.4	1.4	1.9	1.4	1.6

	Asian	Non-Asian	Asian	Non-Asian
Traditionality[1]	32.2%	26.1%	60.5%	65.4%
Prestige[2]	69.5	80.9	55.5	72.3
Math-Relatedness[3]	2.6	2.4	1.5	1.6

[1]Average percentage of females in the U.S. work force in occupations selected by each group.

[2]Average prestige rating (NORC Prestige Scale) for careers selected by each group.

[3]Based on a 4-point scale developed for the study. 1 = Basic math required; 2 - Algebra I required; 3 = Geometry required; 4 = Algebra II, Trig or higher math required. (See Appendix B for a copy of the scale.)

[4]Includes mothers with both full-time and part-time jobs.

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Math Study of Son or Daughter

Data comparing parents' and students' responses to the question, "On the average, how much time does _____ (do you) spend on homework per week?" are shown in Table 24. This table highlights the large discrepancies between student reports and parent estimates. A majority of parents (67% of fathers and 51% of mothers) surveyed felt that their children spent more than eight hours per week on homework, but only 36 percent of students reported that much time. Of all the parents, those of high math girls felt that their daughters spent the most time on homework. Mothers of high verbal/low math daughters were the only parent group to underestimate time spent on homework. Differences between the estimates of mothers of students in the three math groups were statistically significant ($p < .05$), with mothers of low math girls estimating less time on homework. Differences between the estimates of Asian and non-Asian parents were also statistically significant ($p < .05$), with Asian parents estimating greater amounts of homework time. There was less discrepancy between the estimates of Asian parents and students than between non-Asian parents and students.

Less than 20 percent of all parents required a specific amount of time spent on homework. Significantly more ($p < .05$) Asian fathers required some time spent on homework than non-Asian fathers; Asian fathers also required that significantly more time be spent ($p < .05$). The majority of parents did not presently help their children with their homework. Of those who did, the majority spent less than two hours per week helping them, and it was usually the father (45%) rather than the mother (16%) who helped with math. Fathers also were typically the parents who helped with math during elementary or junior high for all student groups.

TABLE 24

AVERAGE AMOUNT OF TIME SPENT ON HOMEWORK PER WEEK
AS REPORTED BY STUDENTS AND ESTIMATED BY PARENTS

As Reported By:	Number and Percentage Who Gave Each Response											
	No Time		Less Than 2 Hours		2-4 Hours		5-8 Hours		More Than 8 Hours		Don't Know	
	N	%	N	%	N	%	N	%	N	%	N	%
High Math Boys	5	8.5%	6	10.2%	16	27.1%	12	20.3%	20	33.9%	0	--
Fathers of High Math Boys[1]	0	--	1	2.1%	5	10.6%	9	19.1%	29	61.7%	3	6.4%
Mothers of High Math Boys[1]	0	--	3	5.2%	13	22.4%	9	15.5%	31	53.4%	2	3.4%
High Math Girls	5	11.4%	1	2.3%	6	13.6%	13	29.5%	19	43.2%	0	--
Fathers of High Math Girls[1]	0	--	0	--	1	2.6%	5	13.2%	31	81.6%	1	2.6%
Mothers of High Math Girls[1]	0	--	0	--	1	2.3%	8	18.2%	35	79.5%	0	--
High Verbal/Low Math Girls	2	8.0%	3	12.0%	6	24.0%	6	24.0%	8	32.0%	0	--
Fathers of High Verbal/Low Math Girls[1]	0	--	1	5.3%	3	15.8%	5	26.3%	10	52.6%	0	--
Mothers of High Verbal/Low Math Girls[1]	0	--	5	17.2%	9	31.0%	14	48.3%	1	3.4%	0	--
Asian Students[2]	1	3.6%	3	10.7%	6	21.4%	4	14.3%	14	50.8%	0	--
Asian Fathers[2]	0	--	1	4.5%	0	--	1	4.5%	18	81.8%	2	9.1%
Asian Mothers[3]	0	--	1	3.3%	3	10.0%	1	3.3%	23	76.7%	2	6.7%
Non-Asian Students[2]	11	11.0%	7	7.0%	22	22.0%	27	27.0%	33	33.0%	0	--
Non-Asian Fathers[2]	0	--	1	1.2%	9	11.0%	18	22.0%	52	63.4%	2	2.4%
Non-Asian Mothers[3]	0	--	2	2.0%	16	15.8%	25	24.8%	57	56.4%	1	1.0%

[1]Significance Level: $p < .05$ for differences in estimates of mothers of different math groups.

[2]Significance level: $p < .05$ for differences in estimates of Asian and non-Asian fathers.

[3]Significance level: $p < .05$ for differences in estimates of Asian and non-Asian mothers.

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Educational Plans for Sons or Daughters

Data on parents' educational plans for their children are presented in Table 25. More than 95 percent of parents wanted their children to obtain at least a bachelor's degree. Although differences were not statistically significant, over all parents, aspirations for advanced degrees were highest for high math boys, and lowest for high verbal/low math girls. Mothers had much higher educational aspirations for sons and daughters than did fathers. Fathers of high verbal/low math girls were least likely to select an educational aspiration for their daughters. Fathers of high verbal/low math girls also were less sure (37% sure) than both other groups of parents (69% sure) that their daughters would reach their educational goals. Over 85 percent of parents felt that a good education was very important, and 95 percent felt that their children were definitely going to college. Over 96 percent of parents planned to help their children financially during their college educations.

To determine if there were differences in the types of colleges to which they would be sending their children after high school graduation, parents were asked which school they would prefer the student attend and which school they thought the student would actually attend. Colleges and universities were ranked using a modification of Cass and Birnbaum's (1985) college selectivity index, which is based on selectivity in terms of academic and intellectual admission requirements. According to the authors, the index represents a comparative measurement of the scholastic quality of the student body or the intellectual competition at that school. The scale is not a rating of colleges or the educational accomplishments of their faculty and students. Appendix C contains a listing of sample schools from each of the nine selectivity categories. Selectivity ratings for parents' preferred and the

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TABLE 25

PARENTS' HIGHEST EDUCATIONAL ASPIRATIONS
FOR THEIR CHILDREN

Number and Percentage of Parents Who Reported Each Educational Level:

Highest Educational Level to be Achieved	Fathers: High Math Boys N	Fathers: High Math Boys %	Fathers: High Math Girls N	Fathers: High Math Girls %	Fathers: High Verbal/ Low Math Girls N	Fathers: High Verbal/ Low Math Girls %	Mothers: High Math Boys N	Mothers: High Math Boys %	Mothers: High Math Girls N	Mothers: High Math Girls %	Mothers: High Verbal/ Low Math Girls N	Mothers: High Verbal/ Low Math Girls %
A.A. or Other Degree	2	4.3%	0	--	1	5.3%	1	1.7%	2	4.5%	2	6.8%
B.S./B.A. Degree	11	23.4%	15	39.5%	8	42.1%	15	25.9%	15	34.1%	12	41.4%
Master's Degree	13	27.7%	8	21.1%	3	15.8%	21	36.2%	10	22.7%	9	31.0%
Ph.D. or Other Advanced Degree	16	34.0%	10	26.3%	2	10.5%	17	47.2%	16	36.4%	3	10.3%
Undecided; Don't Know	1	2.1%	0	--	0	--	0	--	0	--	0	--
Refused to Choose	4	8.5%	5	13.2%	5	26.3%	4	6.9%	1	2.3%	3	10.3%

	Asian Fathers N	Asian Fathers %	Non-Asian Fathers N	Non-Asian Fathers %	Asian Mothers N	Asian Mothers %	Non-Asian Mothers N	Non-Asian Mothers %
A.A. or Other Degree	1	4.5%	2	2.4%	1	3.3%	4	4.0%
B.S./B.A. Degree	10	45.5%	24	29.3%	15	50.0%	27	26.7%
Master's Degree	1	4.5%	23	28.0%	4	13.3%	36	35.6%
Ph.D. or Other Advanced Degree	6	27.3%	22	26.8%	9	30.9%	27	26.7%
Undecided; Don't Know	1	4.5%	0	--	0	--	0	--
Refused to Choose	3	13.6%	11	13.4%	1	3.3%	9	6.9%

students' actual choices are shown in Table 26. Overall, parents would prefer to send their children to more selective colleges than their children were actually planning to attend. Again, mothers had higher college aspirations than fathers over all groups. Comparing math groups, parents of high math boys tended to prefer more selective schools for their sons; parents of high math girls preferred somewhat selective schools; parents of high verbal/low math girls were least likely to prefer highly selective schools for their daughters. Approximately one-fourth (26%) of parents listed no preferred school. Asian parents were more likely than non-Asians to state that they had no preference and that choice of college was up to the student.

Table 27 is a listing of college majors preferred by parents. Parents of high math students of both sexes preferred that their children major in mathematics, the physical sciences, computer science, or engineering; fathers of high verbal/low math girls preferred that their children major in business or accounting. Mothers of high verbal/low math girls also preferred liberal arts and humanities majors. Across all parents, 20 to 35 percent had no preference. As with choice of school, Asian parents were most likely to state no preference for their children's college majors.

Career and Future Plans/Values for Sons or Daughters

Parents' career preferences for their children were similar to their college major preferences. Parents of high math boys preferred engineering and physical sciences. Parents of high math girls typically selected medicine or business, and parents of high verbal/low math girls chose business, journalism, and law. Preferences made by parents for their children's careers were scaled for traditionality, prestige, and math relatedness using the scales described earlier. Table 28 includes average values on each scale for parents of each math group.

TABLE 26

SELECTIVITY OF COLLEGE FOR THEIR CHILD:
PREFERRED AND ACTUAL CHOICES

Group	Selectivity[1] Rating of: Preferred School	Actual School
Fathers of:		
High Math Boys	5.8	4.5
High Math Girls	4.8	4.1
High Verbal/Low Math Girls	4.8	2.6
Mothers of:		
High Math Boys	6.2	4.2
High Math Girls	5.5	4.3
High Verbal/Low Math Girls	4.2	3.2
Averages for Both Parents of:		
High Math Boys	6.0	4.4
High Math Girls	5.2	4.2
High Verbal/Low Math Girls	4.4	3.0

[1]Based on a modification of Cass & Birnbaum's (1985) seven-point scales which included two additional categories. Scale values, which reflect the "scholastic potential of the student body" or "the intellectual competition at a school" were: 9 - among the most selective in the country; 8 - highly + selective; 7 - highly selective; 6 - very + selective; 5 - very selective; 4 - selective +; 3 - selective; 2 - non-selective four-year school; and 1 - non-selective two-year school. Categories 1 and 2 were added by the authors.

TABLE 27

COLLEGE MAJORS PREFERRED BY PARENTS

College Major Area	Percentage of Parents Who Preferred That Their Child Major in Each Area: Fathers: High Math Boys	Fathers: High Math Girls	Fathers: High Verbal/ Low Math Girls	Mothers: High Math Boys	Mothers: High Math Girls	Mothers: High Verbal/ Low Math Girls
Engineering	19.1%	15.8%	--	17.2%	4.5%	--
Math/Physical Sciences, Computer Sciences	25.6%	18.4%	15.8%	31.0%	31.8%	10.3%
Social Sciences	4.3%	5.3%	10.5%	3.4%	--	3.4%
Economics, Business, Accounting	10.6%	7.9%	31.6%	8.6%	13.6%	24.1%
Humanities, Liberal Arts, Journalism	10.6%	7.9%	5.3%	6.9%	9.1%	27.6%
Education	--	5.3%	5.3%	3.4%	2.3%	10.3%
Art, Music	2.1%	--	5.3%	--	2.3%	--
Other, including Trade/Technical Training	4.3%	5.3%	--	3.4%	4.5%	3.4%
Don't Know, No Preference	23.4%	34.2%	26.3%	25.9%	31.8%	20.7%

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TABLE 28

TRADITIONALITY, PRESTIGE, AND MATH-RELATEDNESS
OF PARENTS'[1] PREFERENCES FOR THEIR CHILDREN'S CAREERS

	Traditionality[2]	Prestige[3]	Math-Relatedness[4]
Fathers of:			
High Math Boys	21.6%	90.8	2.8
High Math Girls	26.4%	90.4	2.4
High Verbal/Low Math Girls	38.4%	87.6	1.7
Mothers of:			
High Math Boys	23.3%	92.2	2.8
High Math Girls	27.9%	90.7	2.5
High Verbal/Low Math Girls	42.3%	85.3	1.6
Asian Fathers	30.8%	89.6	2.3
Non-Asian Fathers	25.7%	90.1	2.5
Asian Mothers	29.4%	88.3	2.3
Non-Asian Mothers	28.4%	91.0	2.5

[1]Averages are based on responses of 158 parents, which represents 68 percent of those sampled; 34 percent of parents did not state a career preference.

[2]Average percentage of females in the U. S. work force in occupations selected by each group.

[3]Average prestige rating (NORC Prestige Scale) for careers selected by each group.

[4]Based on a 4-point scale developed for the study. 1 = Basic math required; 2 = Algebra I required; 3 = Geometry required; 4 = Algebra II, Trig or higher math required. (See Appendix B for a copy of the scale.)

Both mothers and fathers wanted highly prestigious careers for their children, with male dominated careers being the most desired ones, especially for parents of high math boys and girls. Parents of high math Asian boys wanted the most prestigious and the most male-oriented careers requiring advanced mathematics for their sons. Parents of high verbal/low math girls tended to select careers which were more traditionally female and were less math related.

When asked about the student's own career choices, the majority of parents felt that their children chose their respective careers primarily because they liked the subject area or because they were good at it and had the ability to perform well. When parents of students who had selected low math or science-related careers were asked the reasons for their career choices, the most frequently given response was that their son or daughter didn't like math. Very few parents said they would discourage their children from any career. Of those who would, the military, the parents' current occupation, low paying or low prestige, and any illegal activities were listed as those they would discourage their children from pursuing.

The majority (over 95%) of parents would still want their children to work, even if it were not financially necessary to do so, primarily to have a purpose in life (for boys) and for personal development (for girls). Parents were equally split on their opinions of whether they wanted their children to have a part-time career or no career at all at some time during their adult lives. If they were in favor of a part-time or no career, the predominant reason was for daughters to care for their children and family. More than 80 percent of parents felt that both a career and family were equally important for their sons and daughters.

The most important values which parents would like to give their children included hard work, education, love, consideration of others, honesty, independence, self-respect and integrity. Overall, Asian parents favored hard work and effort with non-Asian parents favoring love, family, and consideration of others. Parents of non-Asian girls stressed independence, self-respect, and love; parents of non-Asian boys stressed honesty, love, and consideration of others. Parents of Asian boys favored hard work and honesty, with the parents of Asian girls emphasizing hard work, love, and the consideration of others.

Parents' Opinions About Their Son's or Daughter's Aptitudes and Abilities

Popularity - In contrast to student reports, almost 90 percent of parents of all groups felt that their sons and daughters were about as popular or more popular than other students. There were no differences between parents of math groups; Asian parents saw their children as more popular than did non-Asian parents, but the difference was not statistically significant.

Math Ability - Included in Table 29 are parents' ratings of their children's math abilities as compared with those of other students. Since fathers' and mothers' ratings were very similar, they have been combined in the table. Significantly more ($p < .01$) parents of high math boys and girls felt their children's math ability was much higher than other students, as did non-Asian parents ($p < .01$). Parents of high math students also recognized their ability at an early age (5, 6, or 7 years old) because they did well in school with little effort. Parents of high verbal/low math girls felt their daughters' math abilities were only "somewhat higher" than other students and noticed their abilities at about age 12 because of their relatively lower performance in math at school.

TABLE 29

PARENTS' RATINGS OF THEIR CHILDREN'S MATH ABILITY

Parents of:	Number and Percentage of Parents[1] Who Rated Their Child's Math Ability as Compared With Other Same-Age Students:									
	Much Higher		Somewhat Higher		About the Same		Somewhat or Much Lower		Don't Know	
	N	%	N	%	N	%	N	%	N	%
High Math Boys**	66	62.9%	26	24.8%	7	6.7%	1	1.0%	5	4.8%
High Math Girls**	45	54.9%	28	34.1%	9	11.0%	0	--	0	--
High Verbal/Low Math Girls**	6	12.5%	23	47.9%	14	29.2%	4	8.3%	1	2.1%
Asian Students**	16	30.8%	18	34.6%	13	25.0%	1	1.9%	4	7.7%
Non-Asian Students**	101	55.2%	59	32.2%	17	9.3%	4	2.2%	2	1.1%

[1]Combined for mothers and fathers.

**Chi Square level of significance between parents of student math groups and between Asian and non-Asian parents: $p < .01$

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The majority of all parents (83.7% of fathers and 76.3% of mothers) felt their children's math ability could be improved; over all parents, more classes and better teachers were listed as "what could be done to improve math ability." Asian mothers, however, were significantly ($p < .01$) more likely to feel that improvement would result from more studying and effort (53.3% vs. 19.8% for non-Asian mothers); mothers of high verbal girls were significantly ($p < .01$) more likely to state that their daughters needed greater interest in math and awareness of its usefulness (40.4% vs. 5% of mothers of high math students). Of those who did not feel their children's ability could be improved, reasons given were that their abilities were already high or that there was no interest in doing better.

Math Achievement - Parents of high math boys and girls felt their children's math achievement was much higher than other students (see Table 30). Parents of high verbal/low math girls, however, felt their daughter's math achievement was about the same or somewhat higher than other students. Fathers tended to indicate slightly higher achievement levels than mothers. Non-Asian parents were significantly ($p < .01$) more likely to rate their children much higher than others. The majority of fathers in the sample did not believe their children's math achievement had differed from elementary or junior high to high school, but the majority of mothers did see changes in achievement levels. Mothers of high math boys and girls were significantly ($p < .01$) more likely to report improvement in math achievement, whereas mothers of high verbal girls reported a reduction in math achievement levels. If there had been changes, these changes occurred around ages 12-14 and were attributed to good or bad teachers, more coursework or more effort and studying by the student.

TABLE 30

PARENTS' RATINGS OF THEIR CHILDREN'S MATH ACHIEVEMENT

Parents of:	Number and Percentage of Parents[1] Who Rated Their Child's Math Achievement as Compared With Other Same-Age Students: Much Higher N	%	Somewhat Higher N	%	About the Same N	%	Somewhat or Much Lower N	%	Don't Know N	%
High Math Boys**	51	48.6%	37	35.2%	8	7.6%	2	1.9%	7	6.7%
High Math Girls**	40	48.8%	34	41.5%	8	9.8%	0	--	0	--
High Verbal/Low Math Girls**	1	2.1%	21	43.8%	17	35.4%	8	16.7%	1	2.1%
Asian Students**	12	23.1%	24	46.2%	8	15.4%	1	1.9%	7	13.5%
Non-Asian Students**	80	43.7%	68	37.2%	25	13.7%	9	4.9%	1	.5%

[1]Combined for mothers and fathers.

**Chi Square level of significance between parents of student math groups and between Asian and non-Asian parents: $p < .01$

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Liking for Math - Parents' ratings of their children's liking for math are presented in Table 31. Parents' ratings for math groups were significantly different, with more low math boys rated as liking math, and more high verbal/low math girls rated as feeling neutral or disliking math. Parents of high math girls rated them between the two groups. There were no differences between ratings of Asian and non-Asian parents. Students' feelings about math were noted at around ages 12-14; high math students expressed an interest in math, whereas high verbal/low math girls complained about the difficulty of math. About half of all parents felt their children had previously liked math more, and they attributed the change to the increasing difficulty of math. They also felt that their children could like math more if they saw math as more useful, or if there were better teachers or courses. Significantly more ($p < .01$) Asian parents were uncertain whether or not their children could like math more.

Perceived Influence

Over 82 percent of fathers and 89 percent of mothers reported that their son or daughter discussed their career choices with them. Almost 25 percent of students discussed career plans often or very often with their fathers, and over 50 percent discussed career plans often or very often with their mothers. Asian parents were less likely to report career discussions with their children. Parents were asked about the level of influence they desired and their actual level of influence over their child's high school course selections (Table 32) and career choices (Table 33). Non-Asian parents felt they had a fair amount of influence on their children's high school course enrollment and career choices and were content with that amount. Asian parents, however, felt they had little or no influence on their children's career choices or high school course enrollment and were satisfied with that.

TABLE 31

PARENTS' RATINGS OF THEIR CHILDREN'S LIKING FOR MATH

Parents of:	Number and Percentage of Parents Who Rated Their Child's Liking for Math:											
	Likes A Great Deal		Likes Somewhat		Neutral		Dislikes Somewhat		Really Dislikes		Don't Know	
	N	%	N	%	N	%	N	%	N	%	N	%
High Math Boys**	46	43.8%	42	40.0%	8	7.6%	3	2.9%	4	3.8%	2	1.9%
High Math Girls**	27	32.9%	31	37.8%	15	18.3%	4	4.9%	4	4.9%	1	1.2%
High Verbal/Low Math Girls**	4	8.3%	17	35.4%	13	27.1%	7	14.6%	7	14.6%	0	--

[1]Combined for mothers and fathers.

**Chi Square significance level for difference between groups: $p < .01$.

NOTE: Differences between Asian and non-Asian parents were not statistically significant, so their rating breakdown was not included in the table.

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TABLE 32

PARENTS' DESIRED VS ACTUAL INFLUENCE ON CHILDREN'S HIGH SCHOOL COURSE CHOICES

	Percentage of Parents With Each Level of Desired and Perceived Actual Influence:					
	None to Slight Amount		Fair Amount		Great Deal	
Parent Groups	Desired	Actual	Desired	Actual	Desired	Actual
Fathers of:						
High Math Boys	38.3%	51.0%	34.0%	34.0%	27.7%	14.9%
High Math Girls	39.5%	44.8%	34.2%	26.3%	26.3%	28.9%
High Verbal/Low Math Girls	36.8%	36.9%	47.4%	52.6%	15.8%	10.5%
Mothers of:						
High Math Boys	38.0%	44.9%	39.7%	36.2%	22.4%	19.0%
High Math Girls	43.3%	50.0%	31.8%	25.0%	25.0%	25.0%
High Verbal/Low Math Girls	31.0%	44.7%	51.7%	41.4%	17.2%	13.8%
Asian Fathers**	68.2%	72.8%	18.2%	13.6%	13.6%	13.6%
Non-Asian Fathers**	30.9%	39.1%	41.5%	40.2%	28.0%	20.7%
Asian Mothers**	50.0%	70.0%	26.7%	10.0%	23.3%	20.0%
Non-Asian Mothers**	34.6%	39.6%	43.6%	40.6%	21.8%	19.8%

** p <.01 for differences between: 1) Asian and non-Asian fathers' desired influence.
2) Asian and non-Asian fathers' perceived actual influence.
3) Asian and non-Asian mothers' desired influence.
4) Asian and non-Asian mothers' perceived actual influence.

TABLE 33

PARENTS' DESIRED VS ACTUAL INFLUENCE ON CHILDREN'S CAREER CHOICES

Parent Groups	Percentage of Parents With Each Level of Desired and Perceived Actual Influence: None to Slight Amount Desired	None to Slight Amount Actual	Fair Amount Desired	Fair Amount Actual	Great Deal Desired	Great Deal Actual
Fathers of:						
High Math Boys*	59.6%	63.8%	31.9%	31.9%	8.5%	4.3%
High Math Girls*	65.8%	76.3%	15.8%	13.2%	18.4%	10.5%
High Verbal/Low Math Girls*	47.4%	73.7%	52.6%	15.8%	--	10.5%
Mothers of:						
High Math Boys	69.0%	69.0%	22.4%	27.6%	8.6%	3.4%
High Math Girls	70.4%	70.5%	20.5%	15.9%	9.1%	13.6%
High Verbal/Low Math Girls	65.5%	69.0%	34.5%	31.0%	--	--
Asian Fathers	81.8%	90.9%	9.1%	--	9.1%	9.1%
Non-Asian Fathers	53.6%	64.7%	35.4%	28.0%	11.0%	7.3%
Asian Mothers*	66.7%	76.7%	23.3%	13.3%	10.0%	10.0%
Non-Asian Mothers*	69.3%	67.3%	24.8%	27.7%	5.9%	5.0%

* $p < .05$ for differences between: 1) fathers of math groups on desired career influence.
2) Asian and non-Asian mothers on perceived actual career influence.

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An interesting finding was that most parents felt they had much more influence on their children's course selections and career choices than the students acknowledged (compare the data in Tables 32 and 33 with that in Table 14).

A majority of all parents (75% of fathers and 73% of mothers) had encouraged their children to enroll in math or science courses; however, only 33 percent of parents had actively encouraged their children in pursuing a career in these fields. Only 19 percent of parents of high verbal/low math girls reported attempts to encourage their daughters in math or science-related careers. Almost all parents had participated in a number of educational activities (library, puzzles, games, etc.) with their children, with mothers usually being more involved than fathers. Parents of both high math groups were significantly ($p < .01$) more likely to have provided a home computer for their children than were parents of high verbal/low math girls. There were several statistically significant differences between Asian and non-Asian parents. Fewer Asian parents reported encouraging learning math or science ($p < .05$), playing word puzzles ($p < .01$), playing games of strategy ($p < .01$), playing card games ($p < .01$), and teaching building skills ($p < .05$). A summary of these data can be found in Table 34, which also included Asian and non-Asian student responses to these items for a comparison. The responses of Asian parents and students were more discrepant than those of non-Asians.

Parents' Math-Related Attitudes

Parents' mean scores on several math attitude scales are presented in Table 35. All parents felt that math was very useful for their children to know. In general, mothers were slightly less stereotyped about math being a male domain than fathers, and both parents of boys were significantly ($p < .01$) more stereotyped than parents of girls in the sample. Fathers of high verbal/low math girls were the least stereotyped. Most parents were similar

TABLE 34

PARENTS'[1] USE OF STRATEGIES TO ENCOURAGE LEARNING

Learning Strategies or Activities Conducted by Parents	Percentage of Parents of Each Student Group Who Used Each Strategy: High Math Boys	High Math Girls	High Verbal/ Low Math Girls	Asian Parents[2]	Non-Asian Parents[3]
Encouraged learning math/science	75.2	72.0	77.1	51.9 *	79.8
Encouraged math/science careers	35.2	39.0	18.8	23.1	36.1
Provided educational toys	87.6	91.5	89.6	80.8 (30.0)	91.8 (78.0)
Provided math/science toys	81.0	78.0	68.8	65.4 (40.0)	80.9 (64.0)
Encouraged reading	94.3	97.6	95.8	90.4 (83.0)	97.3 (88.0)
Encouraged library visits	76.2	86.6	87.5	65.4 (83.0)	86.9 (85.0)
Provided books	88.6	93.9	95.8	78.8 (90.0)	95.6 (87.0)
Played word puzzles	76.2	81.7	77.1	55.8 (53.0)**	84.7 (72.0)
Played games of strategy	76.2	72.0	62.5	46.2 (70.0)**	79.2 (68.0)
Played card games	84.8	86.6	81.2	59.6 (77.0)**	91.8 (77.0)
Taught building skills	64.8	64.6	68.8	46.2 (57.0)*	71.0 (71.0)
Taught change-making	75.2	76.8	77.1	59.6 (80.0)	80.9 (65.0)
Taught to tell time	80.0	84.1	77.1	61.5 (67.0)	86.3 (79.0)
Taught math puzzles and problems	61.0	68.3	56.2	44.2 (63.0)	67.8 (66.0)
Provided home computer	65.7**	73.2**	20.8	69.2 (37.0)	56.3 (42.0)
Taught programming skills	9.5	14.6	4.2	7.7 (7.0)	10.9 (24.0)

[1]Combined across both parents.

[2]Student responses are provided in parentheses for comparison.

*Chi Square significance level for differences between groups: $p < .05$.

**Chi Square significance level for differences between groups: $p < .01$.

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TABLE 35

MEANS AND SIGNIFICANCE LEVELS OF F FOR PARENTS' SCORES ON MATHEMATICS ATTITUDE SCALES BY STUDENT MATH GROUPS

Scale	Mean Scores for Fathers of			Mean Scores for Mothers of			Maximum Possible Score	Significance Level of F (Combined Across Mothers and Fathers)
	High Math Boys	High Math Girls	High Verbal/ Low Math Girls	High Math Boys	High Math Girls	High Verbal/ Low Math Girls		
Math Usefulness	46.6	46.2	44.9	45.6	47.7	44.9	60	n.s.
Math as a Male Domain[1]	53.1	55.7	58.5	54.5	57.6	57.9	65	**
Enjoyment of Math	31.8	35.1	35.5	32.5	34.4	32.2	50	n.s.
Math Anxiety[2]	6.2	7.3	6.2	5.6	5.6	5.7	10	n.s.
Math Confidence	28.6	29.3	27.9	26.4	27.5	24.9	40	n.s.
Attitudes Toward Success in Math	11.1	12.1	13.0	11.3	12.0	13.2	15	**
Peer Attitudes Regarding Math	7.8	7.5	8.4	7.7	7.7	7.9	10	n.s.
Need Achievement	23.8	24.8	25.4	23.7	24.2	23.3	30	n.s.
Attitudes Toward Women[3]	30.3	32.2	34.6	32.6	34.0	33.8	40	*

[1] A high score indicates absence of stereotyping.

[2] A high score indicates absence of anxiety.

[3] A high score indicates nontraditional attitudes.

* $p < .05$
** $p < .01$

in their enjoyment of math and anxiety about math. Fathers generally liked math more and were less anxious about it than mothers. Parents of high math boys and girls were slightly more confident in math than parents of high verbal/low math girls. Mothers were less confident than fathers in math. Parents of boys placed significantly ($p < .01$) less emphasis on intelligence versus popularity of their sons, whereas parents of girls placed a stronger emphasis on intelligence, as measured by the "Attitudes Toward Success in Math Scale". Significant differences on attitudes toward women and on traditional versus nontraditional attitudes were also found. Mothers tended to be more liberal in their attitudes toward women, and parents of girls were significantly ($p < .05$) more liberal than parents of boys.

In Table 36, the same data are presented in terms of ethnic origin of parents. Asian parents rated math significantly ($p < .05$) lower in usefulness, were more likely to stereotype math as a male subject ($p < .01$), were more anxious ($p < .05$) and less confident ($p < .01$) about math, placed greater emphasis on their child's popularity ($p < .01$), were lower in need achievement ($p < .01$), and were more traditional in their attitudes toward women ($p < .01$).

Attributions

Data describing the factors to which parents attribute success or failure in math for their sons and daughters are shown in Table 37. Parents of high math students attributed success primarily to environment, effort and ability, but parents of high verbal/low math students attributed success primarily to environment and effort. These parents were significantly ($p < .01$) less likely to attribute success in math to their daughters' abilities. Non-Asian parents were significantly ($p < .01$) more likely to attribute success to environment and ability and less likely to attribute it to characteristics of the task ($p < .05$).

TABLE 36

MEANS AND SIGNIFICANCE LEVELS OF F FOR PARENTS' SCORES ON MATHEMATICS ATTITUDE SCALES BY ETHNIC GROUP

Scale	Mean Scores for Asian Parents		Mean Scores for Non-Asian Parents		Maximum Possible Score	Significance Level of F
	Fathers	Mothers	Fathers	Mothers		
Math Usefulness	43.8	44.3	46.7	46.7	60	*
Math as a Male Domain[1]	49.7	50.0	56.5	58.2	65	**
Enjoyment of Math	33.7	31.5	35.4	33.5	50	n.s.
Math Anxiety[2]	6.0	5.1	6.8	5.8	10	*
Math Confidence	26.7	23.6	29.3	27.3	40	**
Attitudes Toward Success in Math	10.6	10.5	12.2	12.3	15	**
Peer Attitudes Regarding Math	9.1	7.2	7.4	7.9	10	n.s.
Need Achievement	22.7	22.1	24.9	24.2	30	**
Attitudes Toward Women[3]	29.5	29.7	32.4	34.4	40	**

[1] A high score indicates absence of stereotyping.

[2] A high score indicates absence of anxiety.

[3] A high score indicates nontraditional attitudes.

* $p < .05$
** $p < .01$

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TABLE 37

PARENTS' ATTRIBUTIONS FOR STUDENTS' SUCCESS OR FAILURE IN MATH

	Average Attributions[1] for Success:			
	Environment	Effort	Task	Ability
Fathers of				
High Math Boys	8.3	7.0**	5.5	7.7**
High Math Girls	8.3	8.1**	5.2	7.0**
High Verbal/Low Math Girls	8.7	7.9**	5.2	6.2**
Mothers of				
High Math Boys	8.5	6.6**	5.6	7.4**
High Math Girls	8.9	7.8**	5.8	7.3**
High Verbal/Low Math Girls	9.1	7.4**	6.2	6.3**
Asian Fathers	8.2**	7.5	5.8*	6.5**
Asian Mothers	8.0**	7.1	6.5*	6.7**
Non-Asian Fathers	8.4**	7.6	5.2*	7.4**
Non-Asian Mothers	8.9**	7.2	5.6*	7.3**
	Average Attributions[1] for Failure:			
Fathers of				
High Math Boys	5.7	7.7	6.2	4.0**
High Math Girls	5.7	7.2	6.2	4.0**
High Verbal/Low Math Girls	5.6	7.1	5.7	5.5**
Mothers of				
High Math Boys	5.1	7.4	6.1	3.7**
High Math Girls	5.8	7.6	6.5	3.8**
High Verbal/Low Math Girls	6.0	7.3	6.6	5.6**
Asian Fathers	5.5	6.6	6.1	4.8*
Asian Mothers	5.6	7.2	6.2	4.7*
Non-Asian Fathers	5.7	7.6	6.1	4.1*
Non-Asian Mothers	5.5	7.5	6.4	3.9*

[1]Based on a 10-point scale.

* $p < .05$ for differences between Asian and non-Asian parents.

** $p < .01$ for differences between parents of the three math groups or between Asian and non-Asian parents.

Parents of high math boys and girls most frequently attributed failure in math to lack of effort and not lack of ability. Parents of high verbal/low math girls and Asian parents, however, were significantly more likely ($p < .01$) to attribute failure to lack of ability.

Bem Masculinity/Femininity Scale

Most fathers classified themselves as masculine (47.1%) or androgynous (25.0%), with mothers typically classifying themselves as androgynous (34.4%) or feminine (31.3%). Non-Asian mothers most frequently classified themselves as androgynous (40.6%) or feminine (33.7%). Asian mothers, however, most often classified themselves as undifferentiated (46.7%) or feminine (23.3%).

Why Women Don't Choose Math/Science Careers

Parents across all groups generally agreed that women do not pursue careers in math and science because of societal pressures to avoid choosing math careers, lack of encouragement from parents, stereotyping math as a masculine subject, and lack of interest. Other reasons given were that girls receive little encouragement from teachers and counselors, are exposed to few female role models in mathematics, and fear lack of acceptance in science and mathematics-related professions. Reasons given by fathers and not by mothers were that math is too difficult and demanding and that women lack the necessary ability.

DISCUSSION

In past research, differences between males and females have been studied. The design of this study allowed us to compare high math-achieving male and female students, and also to look at within sex similarities and differences by comparing high and low math-achieving females.

Many of the differences found in the study between groups of students were expected, because of the way the groups were originally set up. However, some differences were unexpected. In analyzing our findings, it is important to keep in mind that by selecting students on the basis of SAT scores, the study included only fairly high achieving students who were college bound. Thus, we are looking at a select group of students and their parents.

In this section of the report, findings are summarized for similarities and differences between: 1) high and low math girls; 2) high math boys and girls; 3) parents of the three groups of students; 4) Asian and non-Asian students, combined across sex and math groups; and 5) Asian and non-Asian parents combined across groups.

High and Low Math Girls

Because of the way in which these groups were defined, high math girls scored significantly higher on measures of math ability, achievement, and participation. Our sample of high math girls also scored slightly higher on the verbal portion of the SAT. Although there were no differences between the groups on years of science or on number of honors science classes, high math girls had reached higher levels and had achieved higher science grades. As compared with high verbal/low math girls, low math girls were characterized by substantial decreases in both math grades and liking for math from elementary to high school years, and fewer planned to take more math than required. They currently perceived themselves to be lower in math ability and achievement, but much higher in popularity than high math girls. This latter finding is in agreement with that of Mills (1984), who found that "high math ability girls tended to be socially introverted and 'thinking' types when compared to normal ability girls of the same age." Similarly, Brody and Benbow (1986) found that

highly mathematically talented students perceived themselves as less popular than did less gifted students. Roberts, Sarigiani, and Petersen (1987) found a negative relationship between high mathematics achievement and self image in sixth and seventh grade girls. High math girls in our sample spent more time on homework, whereas low math girls spent slightly more time on extracurricular activities.

In the areas of educational aspirations and career plans, both groups of girls reported similar educational goals. High math girls were more undecided about their educational plans, but more sure of reaching educational goals than were high verbal/low math girls. As expected, more high math girls chose engineering, science, and math majors, and their career choices were more nontraditional and more math related. However, the career choices of both groups of girls were quite nontraditional when compared with the current careers of their mothers. High math girls were also much more unsure of reaching their career goals. Low math girls were slightly more likely to plan on working only until they had children.

High math girls generally reported more influence by their parents, especially by their fathers. For example, fathers helped more with their math homework, fathers were perceived to have had more influence on their choices of high school classes and on their career choices. One-third of high math girls also reported that their fathers influenced their career choices by setting an example, but no low math girls reported being influenced in this way by their fathers. These findings agree with those of Stamp (1979), who found that high math girls identified more with their fathers than with their mothers. Low math girls reported much less parental influence over choices of classes or careers, lower incidences of parents providing math and science toys or home computers, and being more influenced in their career decisions by teachers/counselors, friends, and famous persons.

There were clear differences between the two groups of girls on the math attitude scales. High math girls saw math as more useful, were higher in math enjoyment, motivation, and confidence, and lower in math anxiety. High math girls also had more desire to succeed in math despite peer attitudes; they perceived their mothers as more likely to believe that these high math girls were capable math learners. Low math girls were much more likely than high math girls to attribute math failure to their own lack of ability and less likely to attribute math success to their ability. Both groups classified themselves as androgynous on the Bem Sex Role Inventory, although more high math than low math girls classified themselves as "masculine" (higher in independence, leadership, and risk-taking behaviors). Stamp (1979) found high math girls to be more "masculine" and less"feminine;" however, our data also indicated higher percentages of high math girls classifying themselves as feminine. In terms of actual masculine and feminine scores, there were no differences between the groups.

Finally, the two groups differed in their answers to the question of why more women do not pursue careers in math and science. Both groups cited lack of parental encouragement as one of the key reasons; however, high math girls also listed fear of lack of acceptance, social pressure, and the difficulty of math, whereas low math girls listed lack of interest and fear of math.

Comparison of High Math Girls and Boys

The math and science achievement of high math girls was equal to that of high math boys in every area except MSAT scores, where girls averaged 50 points lower than boys. These SAT score findings duplicated almost exactly the national differences for male-female MSAT scores (Arbeiter, 1984; West & Gross, 1986). As expected, this group of girls also reported that their

elementary and middle school math grades were higher than those of boys. Even though they were currently achieving in math at a level equal to that for boys, the high math girls in our sample rated their own math ability and achievement lower than did boys. This finding is supported by much previous literature (e.g., Burton & Adams, 1984; Fennema & Sherman, 1978; Fox, Brody & Tobin, 1985; Handel, 1986). High math girls were not as positive as boys in their attitudes toward math; they reported a lower degree of "liking for math." These girls also rated their own popularity much lower than boys.

More high math boys planned to obtain advanced degrees. This group was also least undecided about their educational goals. Boys also were much more likely to choose engineering, math or science majors in college.

The career choices of high math girls were very similar to those of boys in terms of traditionality, prestige, and math relatedness; however, these girls were much more unsure of reaching their goals than were boys. High math girls were less stereotyped than other students in terms of careers they would select if they were members of the opposite sex. Another interesting difference between male and female students was that girls saw careers as providing challenge and personal fulfillment, whereas boys saw careers more as a financial necessity or a societal expectation. Fox, Brody & Tobin (1985) reported similar differences in girls' and boys' attitudes toward future careers.

Although both groups of students reported being more influenced by fathers than mothers, more girls reported being influenced a great deal by either parent in terms of high school class selection and career choices. Burton, Peterson & Baker (1985) also found that girls respond more than boys to parental expectations. Since higher percentages of girls reported that their parents had carried out various educational activities with them, it

appears that their parents may have spent more time in actively encouraging them in learning, and particularly in math.

In math-related attitudes, high math girls were less stereotyped regarding math as a male subject, less inhibited by peer attitudes toward them regarding math, less inclined to believe that peers "look down on" girls who do well in math, and less traditional in their attitudes toward women than were boys. The finding that boys exhibited more stereotyped attitudes concerning math has been noted by many other researchers (e.g., Fox, Brody & Tobin, 1985; Visser, 1986). On attributions for math success and failure, high math girls' scores were much closer to those of boys than those of low math girls. High math girls were more likely to classify themselves as "androgynous" (higher on both masculine and feminine traits), whereas boys most often classified themselves as "undifferentiated" (neither strongly masculine or feminine).

When asked why women do not pursue careers in math and science, both boys and girls agreed that social pressure and lack of parental encouragement were two key reasons. Boys also listed "lack of interest" as a primary reason, and girls also listed "fear of lack of acceptance."

Comparison of Parents of Three Math Groups

Parents of the three groups were very similar in demographic characteristics. Single parents (all female) were most frequent in the low math group. Parents of high math girls were most likely to have earned advanced degrees, with parents of low math girls least likely to have done so. More mothers of high math girls than of any other group worked outside the home while their children were growing up. Fewer mothers of high math boys than any other group were currently employed full-time. Fathers of high math girls currently held jobs which were more highly related to math than those of any other

fathers, and mothers of high math girls held jobs which were the least traditional, most prestigious, and most math related as compared with those of other mothers. Mothers of high math girls also were the group with the highest recent college enrollment. Median family incomes for all groups were $50,000 - $60,000 per year.

Some of these findings are in agreement with those of Lyons (1980) who used a discriminant function analysis to predict gifted girls' enrollment in an accelerated or regular math program. He found that "fathers of an accelerated math group were engaged in math-related occupations to a considerably greater extent than were fathers of the regular math group." Lyons also found, however, that mothers of the accelerated math group were less likely to be employed or, if employed, to have resumed employment while the daughter was in high school, rather than earlier. Since no data on socio-economic status of parents were presented, it is unclear whether that could have been a factor. In reviewing past research relating to factors influencing women's nontraditional occupational choice, Auster and Auster (1981) found that the primary factors included: mother working in a high-level nontraditional occupation, father an achievement role model and source of occupational identification for the daughter, both parents supportive, and family socio-economic status high. Our findings for parents of high math girls seemed to be in agreement with these conclusions.

Parents of high math students rated their sons' and daughters' math ability and achievement very highly, and recognized their abilities at an early age (5-7 years). Parents of low math girls rated their daughters' abilities and achievement levels "somewhat higher than others" and noticed their abilities much later (median age 12). Mothers of high verbal/low math girls felt their daughters needed greater interest in math and awareness of its usefulness.

From several indicators, parents' educational aspirations seemed to be highest for high math boys and lowest for high verbal/low math girls, with aspirations for high math girls falling somewhere between these extremes. Fathers of low math girls were less sure than any other group that their child would reach her educational goals. Parents also preferred more selective colleges for high math sons and less selective schools for low math daughters, with selectivity of schools preferred for high math girls falling between.

Parents selected college majors and careers for high verbal/low math daughters which were more traditionally female and less math related than those selected for high math groups. Selections for high math girls were slightly more traditionally feminine and slightly less math related than those selected for high math boys. Parents of both groups of girls emphasized independence and self-respect as important values for their daughters.

Parents of high math boys and girls felt they had more influence on their children's career plans and high school course selection than did parents of high verbal/low math girls; however, most parents perceived their influence to be greater than that reported by students. Davies and Kandel (1981) found that adolescents underestimate the influence of parents, and our findings showed similar discrepancies between student and parent reports. Although three quarters of parents of all groups reported encouraging their children in learning math and science, only about 35-40 percent of parents of high math students and less than 20 percent of parents of high verbal/low math girls had encouraged math and science-related careers. All parents reported participating in a number of educational activities with their children; the only activity on which high math and low math parents clearly differed was on providing a home computer--fewer parents of low math girls did so. Clearly, the parents in our study had made efforts to help and encourage their children's interest in learning in many areas.

Most parent groups were similar on their math attitudes. Major differences were that parents of high math boys held the most stereotyped attitudes concerning mathematics as a male field, placed more emphasis on their sons' popularity rather than intelligence, and were more traditional in their attitudes toward women, as compared with parents of girls in the study.

Parents differed across groups in the factors to which they would attribute their child's success or failure in mathematics. Although all parents attributed success to the environment (i.e., the teacher made it easy), parents of high math boys were most likely of any parent group to attribute success to their son's ability and least likely to attribute it to his effort. Parents of high math girls were most likely of any group to attribute success to effort; however they also attributed success to ability. Parents of low math girls also attributed success to effort, and were least likely to attribute success to their daughter's math ability. For the "math failure" items, all parents attributed failure to lack of effort; however, parents of low math girls were the group most likely to also attribute failure to their daughters' lack of ability.

Comparison of Asian and Non-Asian Students

Overall, there were few differences between Asian and non-Asian students when combined across sex and math ability groups. Asian students had completed more advanced placement math and science classes; they scored an average of 22 points higher on the MSAT, but 44 points lower on the verbal portion of the SAT. This was not surprising, because approximately one third of the Asian students had emigrated to the United States after completing some portion of their educations outside this country. Asian students also spent more time on homework, and they consistently listed additional studying as the

single most important factor that would improve their math ability and achievement. These findings are in agreement with those of Campbell and Connolly (1984), who also reported that gifted Asian students worked harder and spent more time studying.

There were also few differences in educational and career plans. Asian students were more likely to select college majors in art, music, medicine, and law, and non-Asian students chose business; both groups most frequently chose engineering and science. There were no significant differences in career and family plans.

As compared with non-Asians, Asian students felt they were more influenced by their fathers and less influenced by their mothers in their career choices. Students reported no differences in parental encouragement through participating in educational activities.

The only differences found in math attitudes were that non-Asian students were more likely to believe that peers look down on successful math students and that Asian parents were perceived by their children as being more traditional in their attitudes toward independence and male/female roles.

Comparison of Asian and Non-Asian Parents

In contrast to the high degree of similarity between Asian and non-Asian students, data on parents revealed many more areas in which the two groups differed. One reason for these differences is that, although approximately two-thirds of the Asian students were U.S.-born, over two-thirds of their parents were born outside the United States. Thus it could be assumed that we would find more cultural differences between Asian and non-Asian parents than between Asian and non-Asian students.

Fewer Asian parents had earned advanced degrees, significantly fewer Asian mothers had earned degrees beyond high school, and significantly fewer Asian parents had recently enrolled in college. Asian parents held less prestigious jobs than those of non-Asians and their average family incomes were lower.

Asian parents saw their children as slightly more popular, but rated their math ability and achievement lower than did non-Asian parents. Asian mothers were significantly more likely to feel that improvement in math ability would result from more studying and greater effort.

Asian parents estimated that their sons and daughters spent more time on homework, and significantly more Asian fathers required an amount of time be devoted to studying at home. Asian and non-Asian parents had similar educational aspirations for their children; however, more Asian parents stated they had no preference when asked to choose a college or a major subject for their son or daughter. Asian parents of high math boys chose the most prestigious, most traditionally male, and highest math-related careers for their sons. All parents included honesty, love, and consideration for others as primary values they wanted to give their children. In addition, Asian parents stressed hard work and effort, whereas non-Asian parents stressed independence and self-respect for daughters.

In the area of direct parental influence, our results were surprising. Asian parents were less likely to report discussing their children's career plans with them; they felt they had little influence over their sons' and daughters' high school class and career choices and they were satisfied with that amount of influence. Fewer Asian than non-Asian parents reported that they had encouraged their children in learning math and science or carried out certain types of educational activities with them. In contrast, Campbell and

Connolly (1984) studied gifted Asian and Caucasian boys and girls and found that Asian students were more influenced in high school course selection by their parents than Caucasian students.

The reasons for these findings are unclear. One might speculate that although Asian parents may exert considerable indirect influence over their children's choices of classes and career plans, they may do so in a subtle, rather than overt way. Thus they might see themselves as not particularly influential. Also, Suzuki (1980) noted that Asian American parents are not involved enough with the schools. Several administrators from schools in our sample reported that, although Asian parents value education highly, they seem reluctant to become involved with their children's schools. A final explanation for our seemingly contradictory findings might be cultural or language differences in survey question interpretation by parents in the sample. When we compare Asian parent and student responses on parents' use of strategies and activities to encourage learning (Table 34), we find that in many cases, students perceived more specific activity than reported by parents.

Asian and non-Asian parents differed on most of the math attitude scales used in the survey. Asian parents exhibited more stereotyped attitudes towards mathematics as a male subject and they rated math as lower in usefulness for their children. Asian parents were more anxious and less confident about math. Asian parents also placed greater emphasis on popularity versus intelligence for their sons and daughters; they were lower in need achievement and more traditional in their attitudes toward women. This latter finding is typical of other researchers' conclusions (e.g. Bankart, 1985) that Asians, and especially Asian males, are more traditional and conservative in their attitudes toward women. Some of the other differences we found on math-related attitudes of parents may well have been due to cultural or language

differences, because there were very few differences between Asian and non-Asian students on these scales.

Asian parents were more likely than non-Asian parents to attribute their child's success in math to the easiness of the task, and less likely to attribute it to environment (e.g., the teacher) or to the student's ability. They were also more likely to attribute failure to lack of ability.

CONCLUSIONS AND RECOMMENDATIONS

The high math girls in our sample exhibited the following characteristics:

1) Their families included mothers and fathers who were the most highly educated, with highest math-related occupations, and with the highest percentage of mothers who worked full-time while their daughters were growing up. Thus, at the family level, both parents served as positive role models for high educational values and math-related occupations.
2) These students were more likely than any other group to report a great deal of parental influence on class and career choices, and they exhibited a high degree of "father influence" as compared with low math girls.
3) Their parents appeared to have encouraged them more in math than did any other group of parents, and they set higher educational goals for their daughters than did parents of high verbal/low math girls.
4) The attitudes of high math girls toward mathematics were highly positive. They and their parents attributed success in math to their ability and failure to factors other than ability.
5) Their educational and career plans were more math related than those of high verbal/low math girls, but less so than those of the high

math boys in our sample. They planned to work primarily to gain personal fulfillment.

7) The career choices of both groups of girls were highly nontraditional as compared with their mothers' current occupations. In fact, the career choices of high math girls were quite similar in traditionality to the current occupations of their fathers.

8) High math girls were highly androgynous, describing themselves as high in both traditionally masculine and feminine traits. Their parents emphasized independence and self-respect as values for their daughters.

9) High math girls may have been experiencing more "role conflict"--a finding also noted by Sherman (1982). Indications of this were the findings that high math girls were more undecided about educational goals and less sure of reaching career goals than any other group. They also felt less popular than other students in the sample, and rated their math ability lower than did high math boys, even though the test scores of both groups were at the 96th percentile in math and the grades of high math girls were equal to those of high math boys.

High verbal/low math girls exhibited the following characteristics:

1) They acknowledged less parental influence; high verbal/low math girls exhibited much less influence and evidence of positive relationships with their fathers, who set lower educational goals for their daughters and who also were less sure that these goals would be reached. Their parents had made fewer efforts to encourage them in math-related studies or careers.

2) High verbal/low math girls and their parents were more likely to follow the traditional female pattern of attributing success in math to other factors in the task or environment and attributing failure in math to lack of ability.

3) Their attitudes toward mathematics were less positive than those of high math girls; they spent less time on homework and slightly more time on extracurricular activities, and they considered themselves highly popular with other students.

4) High verbal/low math girls also appeared to have exerted less effort in math--they did not spend as much time on homework, and they were less likely to see increased effort as a way of improving their math ability or achievement.

5) High verbal/low math girls were also highly androgynous and non-stereotyped concerning math as a male subject. Their parents emphasized independence and self-respect as values for their daughters.

6) The educational and career goals of these girls were much less math related than those of other students, but their desired careers were highly prestigious in fields such as law. They planned to work primarily to gain personal fulfillment.

High math boys exhibited the following characteristics:

1) Math and science achievement were high, and boys rated their own popularity as being higher than that of other students. High math boys were more likely than girls to have increased in their math achievement from elementary to high school.

2) High math boys set very high educational goals, and their career plans were more highly math related in fields such as engineering and physical science than those of any other student group. Boys were

also the least undecided about their educational plans, and they planned to work primarily because they would have to support themselves and their families.

3) Parents of high math boys chose the most selective colleges for their sons, and parental aspirations for their educations were higher than for any other group.

4) These boys and their parents held the most stereotyped attitudes concerning mathematics as a male subject and the most traditional attitudes toward women. Boys also believed that peers "look down on" girls who do well in math.

5) High math boys and their parents attributed math success to ability and failure to other factors.

The Asian parents in our sample could be characterized as follows:

1) On the average, Asian parents were less well educated, held less prestigious jobs, and made less money than did non-Asian parents.

2) Asian parents valued their children's education very highly; they required homework, and they stressed hard work and effort. They acknowledged their children's nigh math achievement.

3) Asian parents also valued group membership and popularity with others more than did non-Asian parents.

4) Asian parents perceived that they had exerted little influence over their children's classes and career choices, and they reported fewer instances of actively encouraging their children in study or careers in math.

5) Asian parents were more stereotyped, more traditional, more anxious, and less confident about mathematics. They attributed success to factors other than ability and failure to lack of ability as well as lack of effort.

Eccles and Jacobs (1986) found that parents' perceptions of the difficulty of math for their child and their own attitudes about the value of mathematics substantially influence their children's math course enrollment plans. Our data indicate that parents' efforts can make a substantial difference in encouraging girls in math-related study and careers. An interesting finding was that less than one-third of our students reported being influenced in their career choices by a teacher or counselor. Only 22 percent of high math girls acknowledged teacher or counselor influence. Clearly, it is important that parents, teachers and counselors try to take an active role in helping young women make career decisions.

The high verbal/low math girls in the survey were bright young women, and most of them had liked math and achieved well in it during the elementary grades. At some point around ages 12-14, they began to complain about its difficulty, to be less interested in math, and to receive lower grades. Additional research is needed to determine the elements in this reversal and the steps which could be taken to intervene to halt or reverse the process.

It also appears that today's girls and their parents currently hold less stereotyped, more nontraditional attitudes toward mathematics and toward women in general. Many past projects have been carried out to reduce sex role stereotyping and to effect a shift in women's attitudes. If we are to have a truly egalitarian society, we now need to make similar efforts to change male attitudes.

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APPENDIX A

Parent and Student Questionnaires

PARENT SURVEY -- DAUGHTER

INTERVIEWER NAME _____

DATE OF INTERVIEW _____

NAME OF PERSON INTERVIEWED _____

SEX _____

NAME OF STUDENT _____ SEX _____

PARENT QUESTIONNAIRE

Thank you for agreeing to participate in our survey. The questions I'm going to ask you are designed to give us some information about high school students' and parents' attitudes towards school subjects and careers -- especially about mathematics and related careers. There are no right or wrong answers. We want your opinions, so just answer as honestly as you can.

This survey is being conducted for research purposes only. All of the information you give me will be kept strictly confidential, and will not be released in any way which would identify you or other members of your family.

The questionnaire should take about half an hour to 45 min. to complete. First, I'll be asking you some questions, and then I'd like you to fill out some parts of the questionnaire.
In this research project, we are asking for information from a high school student and her parents. Your daughter [_____] is a student in our sample. Many of the questions I'll be asking you will be referring to "your daughter", so whenever I say, "Your daughter", I'll be referring to [_____].

First, I have some questions about_____'s education and her future plans.

1. On the average, how much time does [_____] spend on homework per week?

_____ NO TIME
_____ LESS THAN 2 HOURS A WEEK
_____ 2-4 HOURS
_____ 5-8 HOURS
_____ MORE THAN 8 HOURS
_____ DON'T KNOW

2. Do you require that she spend a certain amount of time on homework?

YES → 2a. How much time do you require?

_____ REQUIRE WHATEVER NECESSARY
_____ LESS THAN 2 HOURS A WEEK
_____ 2-4 HOURS
_____ 5-8 HOURS
_____ MORE THAN 8 HOURS
_____ DON'T KNOW

NO → GO TO Q. 3

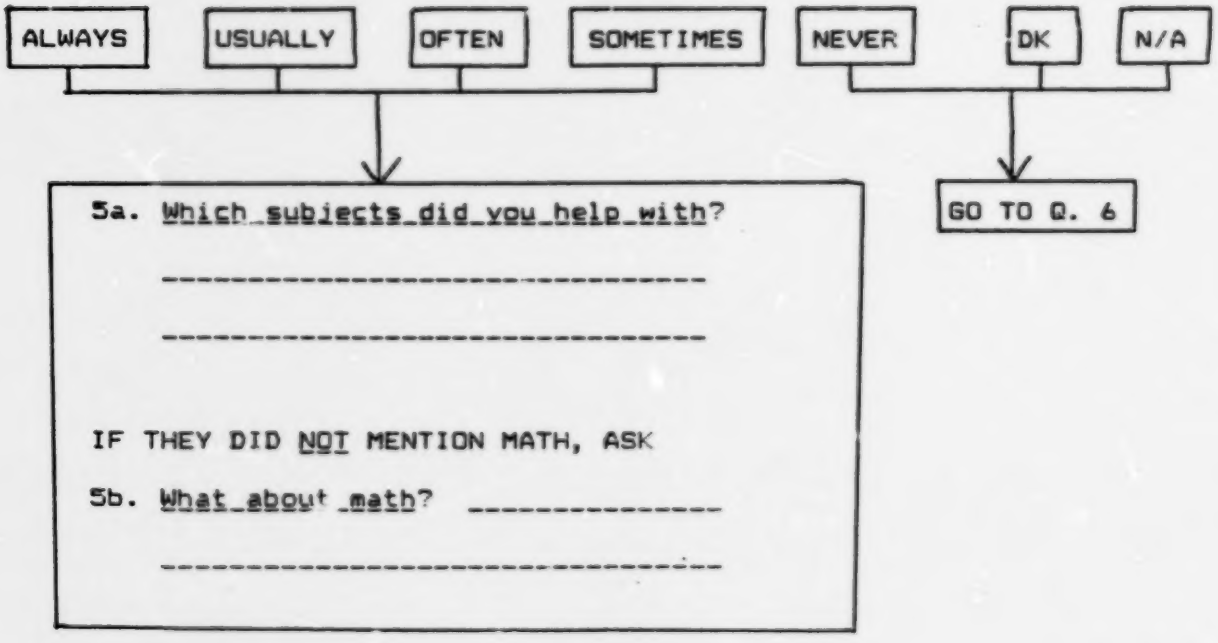
3. On the average, how much time do you spend helping [_____] with her homework each week?

_____ NONE
_____ LESS THAN 2 HOURS PER WEEK
_____ 2-4 HOURS
_____ 5-8 HOURS
_____ MORE THAN 8 HOURS
_____ DON'T KNOW

4. If she ever needs help with math homework, who is most likely to help her?

_____ she NEVER NEEDS HELP
_____ MOTHER
_____ FATHER
_____ EITHER PARENT
_____ DON'T KNOW

5. When [_____] was in elementary school or junior high, how much time did you spend helping her with homework? Would you say that you always helped her, usually helped her, often helped her, sometimes helped her, or never helped her?



6. What is the highest level of education you would like [_____] to achieve someday?

_____ GRADUATE FROM HIGH SCHOOL
_____ 2 YEAR SPECIALIZED TRAINING PROGRAM (EX. ELECTRONICS OR BEAUTY SCHOOL)
_____ GRADUATE FROM JUNIOR COLLEGE (AA DEGREE)
_____ GRADUATE FROM 4 YEAR COLLEGE (BA OR BS DEGREE)
_____ MASTER'S DEGREE
_____ PHD, MD, OR LAW DEGREE
_____ OTHER, LIST:_____
_____ UNDECIDED OR DON'T KNOW GO TO Q. 8
_____ DECLINE TO CHOOSE

7. How sure are you that [_____] will reach this goal someday? Are you very sure, sure, pretty sure, unsure, or very unsure.

VERY SURE	SURE	PRETTY SURE	UNSURE	VERY UNSURE	DK

8. How important is it to you that [_____] have a good education? Is it very important, somewhat important, somewhat unimportant, or very unimportant.

VERY IMPORTANT	SOMEWHAT IMPORTANT	SOMEWHAT UNIMPORTANT	VERY UNIMPORTANT	DK

9. Would you say that [_____] definitely plans to go to college, is pretty sure she will go, is thinking about going, is pretty sure she will not go, or is definitely not going to college.

DEFINITELY GOING	PRETTY SURE YES	THINKING ABOUT GOING	PRETTY SURE NO	DEFINITELY NOT GOING	DK

10. Which school or college would you prefer she attend?

_____

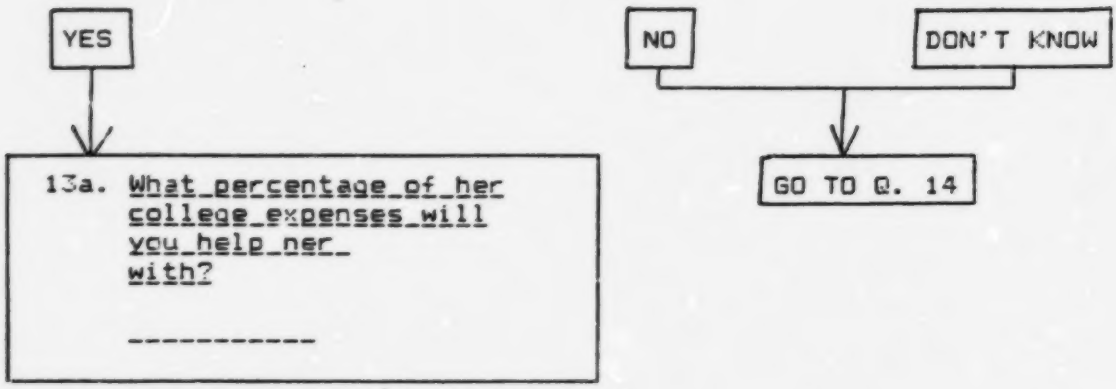
11. Which college do you think that she will attend? _____

_____

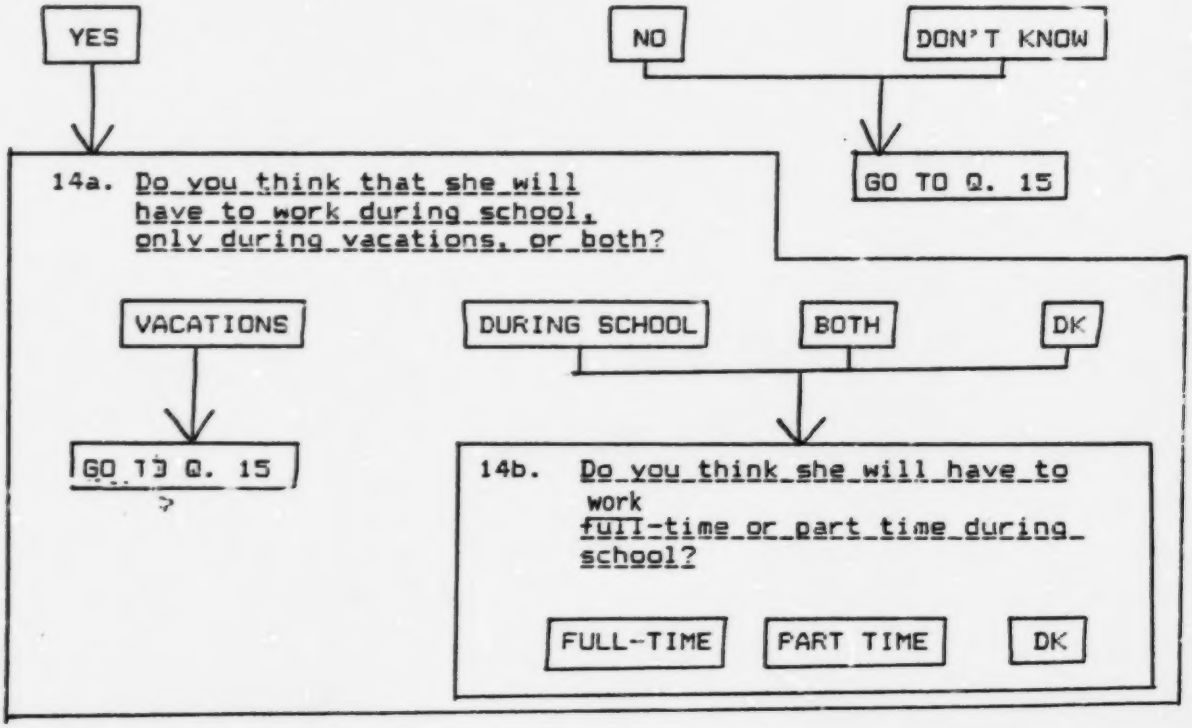
12. If you could choose, what area would you like her to major in in college?

_____

13. If [_____] goes to college, do you plan to help her financially?



14. If she goes to college, will she have to get a part or full-time job to pay some of her expenses?



15. Parents often have wishes about what their children should do with their lives. If you could pick a career for your daughter, what would it be?

_____

_____

16. Is [_____] particularly interested in any career areas at this time?

YES

NO

DON'T KNOW

GO TO Q. 17

16a. What areas?

_____

_____

16b. Why do you think that [_____] will pursue a career in this area?

_____

_____

IF THE AREA IS NOT IN MATH, SCIENCE, COMPUTER SCIENCE, OR ENGINEERING:

16c. Why do you think she will not pursue a career in an area related to mathematics or science?

_____

_____

17. How much influence would you say you've had on the courses that [_____] has taken in high school? Would you say that you have had a great deal of influence, a fair amount of influence, a slight amount of influence, not very much influence, or no influence at all?

GREAT DEAL	A FAIR AMOUNT	A SLIGHT AMOUNT	NOT VERY MUCH	NO INFL.	DK

18. How much influence would you like to have had? A great deal, a fair amount, a slight amount, not very much, or no influence at all?

GREAT DEAL	A FAIR AMOUNT	A SLIGHT AMOUNT	NOT VERY MUCH	NO INFL.	DK

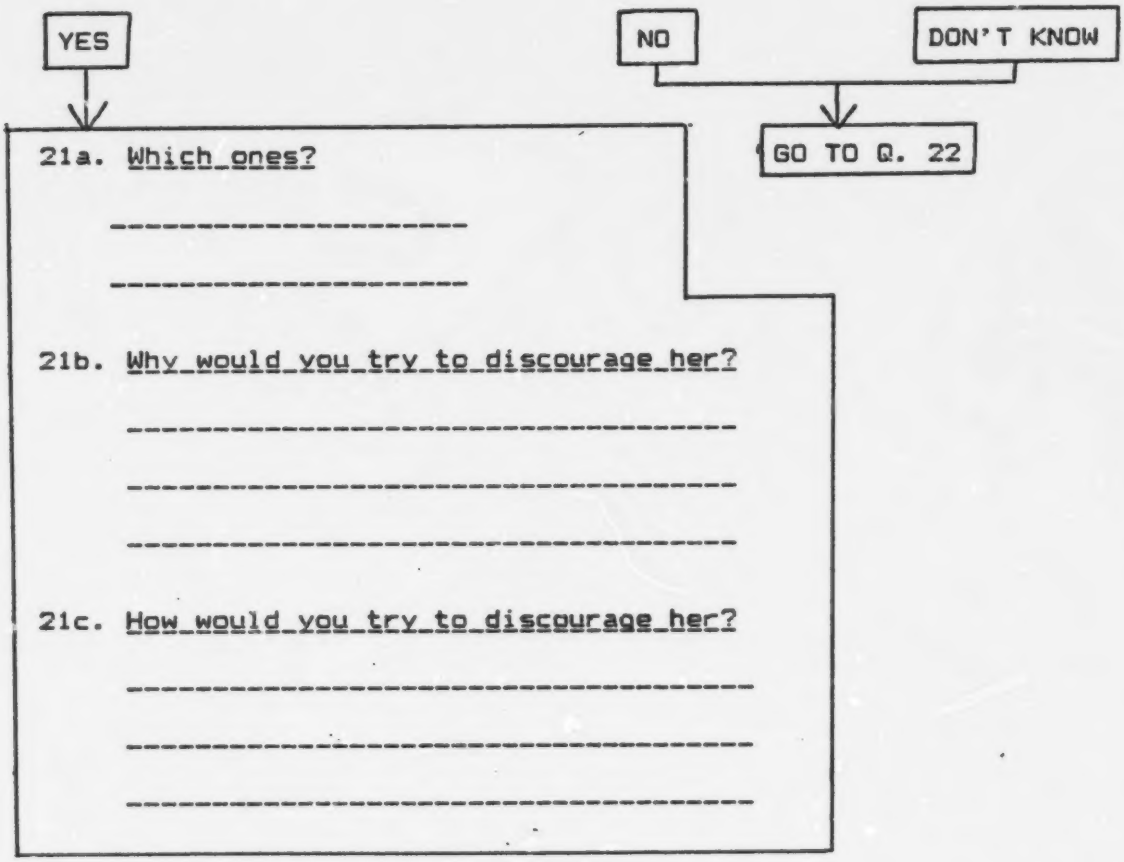
19. How much influence would you say that you have had on _____ [_____]'s career choices? READ CHOICES IF RESPONDENT HAS FORGOTTEN

GREAT DEAL	A FAIR AMOUNT	A SLIGHT AMOUNT	NOT VERY MUCH	NO INFL.	DK

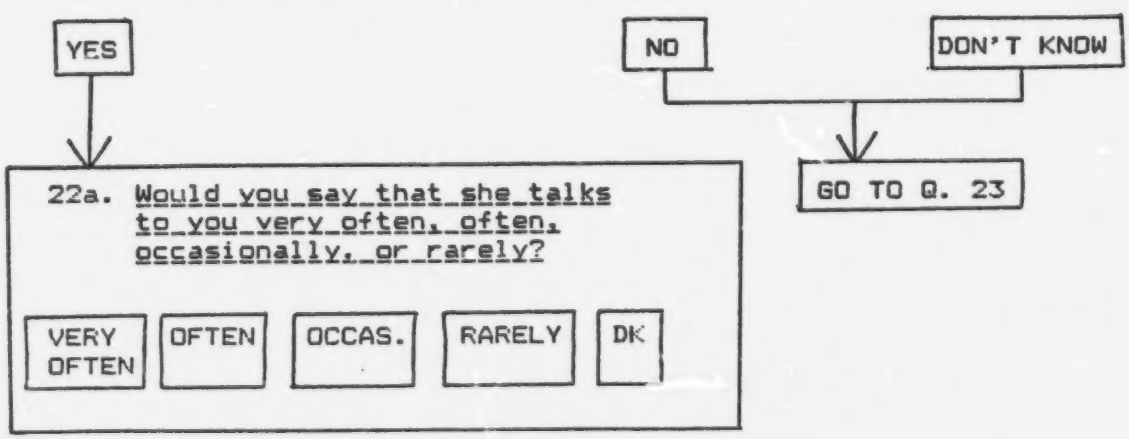
20. How much influence would you like to have had on her career choices? READ CHOICES IF RESPONDENT HAS FORGOTTEN.

GREAT DEAL	A FAIR AMOUNT	A SLIGHT AMOUNT	NOT VERY MUCH	NO INFL.	DK

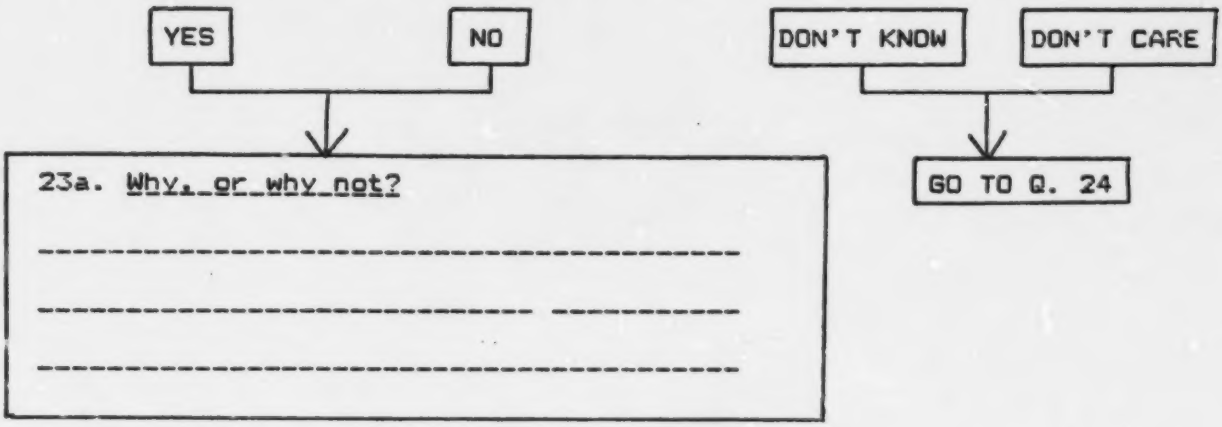
21. Are there any career fields which you would discourage your daughter from pursuing?



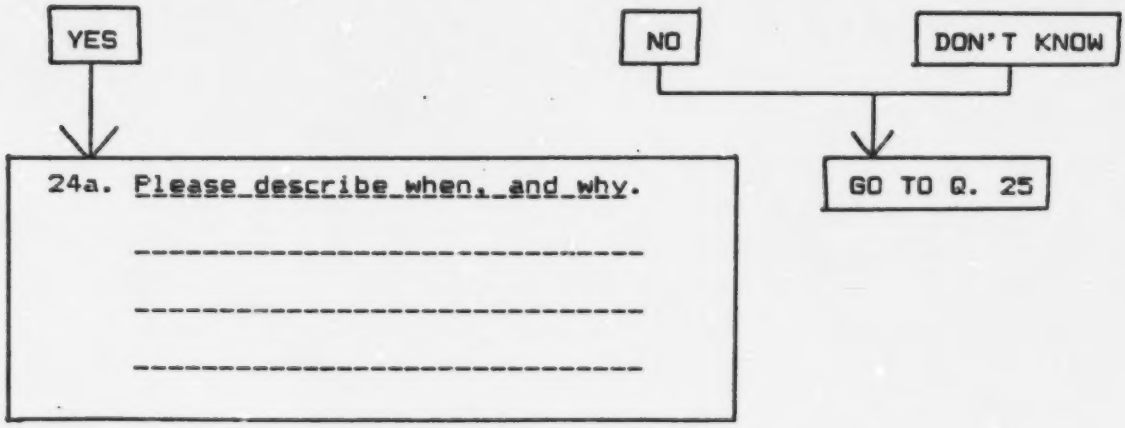
22. Does [_____] talk with you about her career plans?



23. If it were not financially necessary for your daughter to work as an adult, would you still want her to have a career?



24. Do you expect that there will be times in your daughter's adult life when you would prefer she have a part-time career or no career at all?



25. Which of the following statements is most true for you?

____ I think that it is more important for my daughter to have a family rather than to have a good job or career.

____ I think that having a good job or career and having a family are equally important for my daughter.

____ I think it is more important for my daughter to have a good job or career than to have a family.

____ DON'T KNOW

____ REFUSE TO CHOOSE/ NOT MY CHOICE

26. Compared with most other girls in her class, how would you rate your daughter's popularity? Would you say she is much more popular, somewhat more popular, about as popular, somewhat less popular, or much less popular than most other girls?

MUCH MORE POPULAR	SOMEWHAT MORE	ABOUT AS POPULAR	SOMEWHAT LESS	MUCH LESS POPULAR	DK

These next questions are about [_____]'s math ability, her skills or achievement, and her attitudes toward math. By ability, I mean what she's capable of doing. By skills or achievement, I mean what she's doing now. By attitude, I mean how well she likes math.

27. How would you describe [_____]'s math ability as compared to other students in her school? Would you say that her ability is much higher than other students, somewhat higher than other students, about the same as other students, somewhat lower than other students, or much lower than other students.

MUCH HIGHER	SOMEWHAT HIGHER	ABOUT THE SAME AS	SOMEWHAT LOWER	MUCH LOWER	DK

→ GO TO Q.30

28. How old was [_____] when you first noticed her ability level?

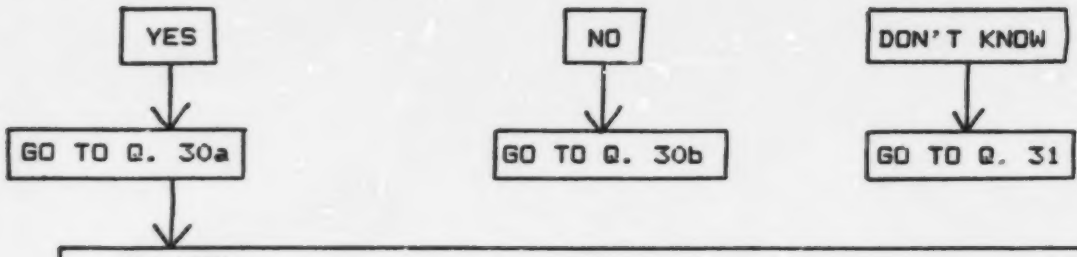
_____

29. What kinds of things did she do that made you realize her ability level?

_____

_____

30. Do you think [_____]'s math ability could be improved?



IF YES:

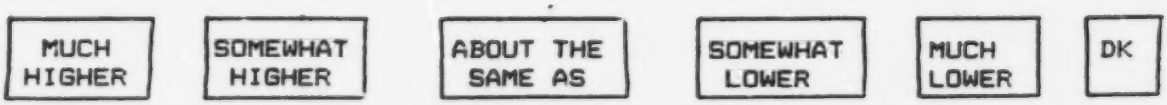
30a. What would have to be done to improve it?

IF NO:

30b. Why do you think her math ability could not be improved?

---

31. How would you describe [_____]'s math achievement and current skills? Would you say her achievement and skill levels are much higher than other students, somewhat higher, about the same, somewhat lower, or much lower than other students?



32. Was there ever a time when she was better or worse at math than she is now?

YES

NO

DON'T KNOW

GO TO Q. 33

32a. Did she improve in math, or did she get worse?

IMPROVED WORSE DK

32b. At about what age did she begin to [improve/get worse]?

32c. Why do you think her math ability changed?

---

33. Do you think that [_____]'s math skills could ever be improved?

YES

NO

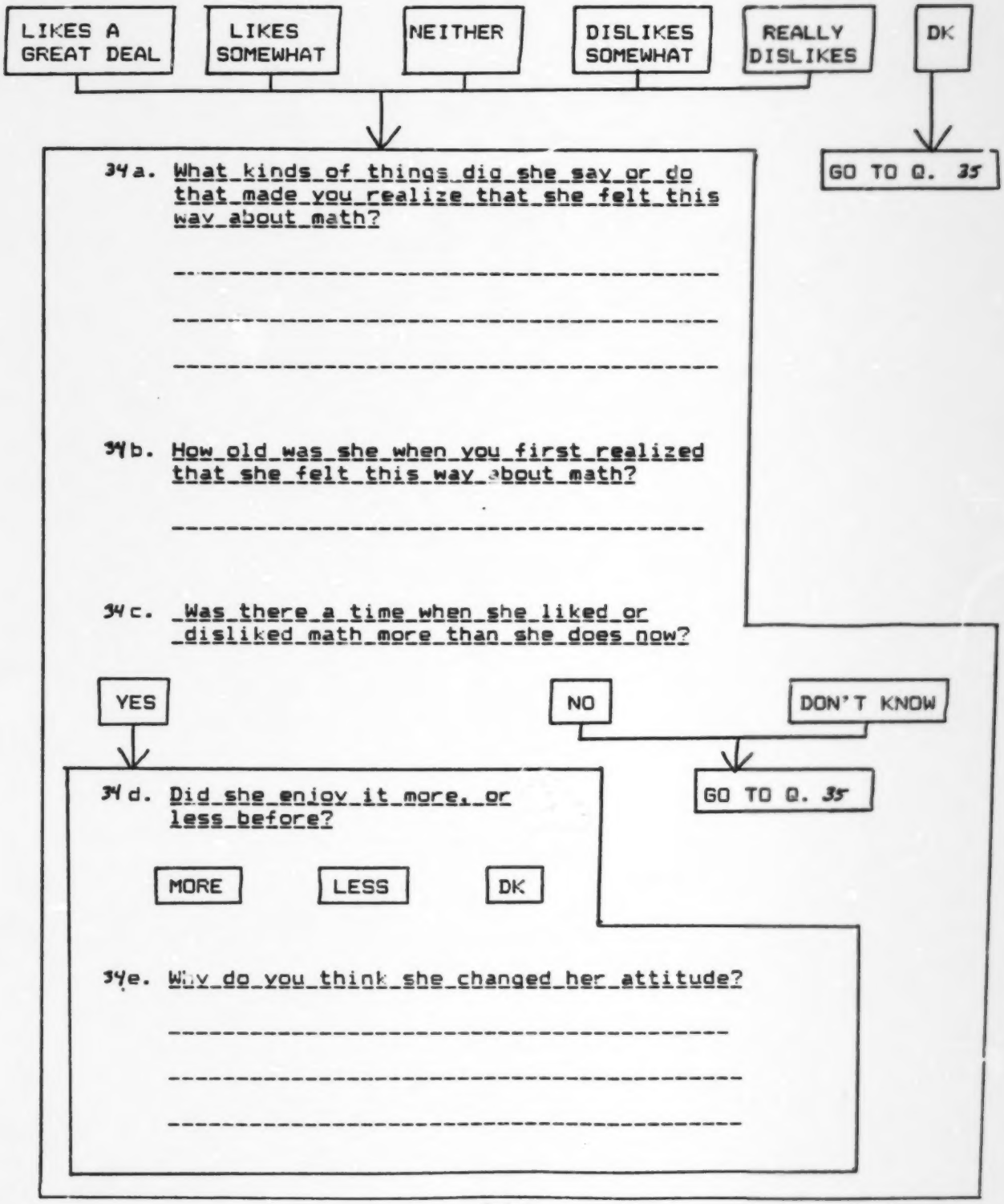
DON'T KNOW

GO TO Q. 34

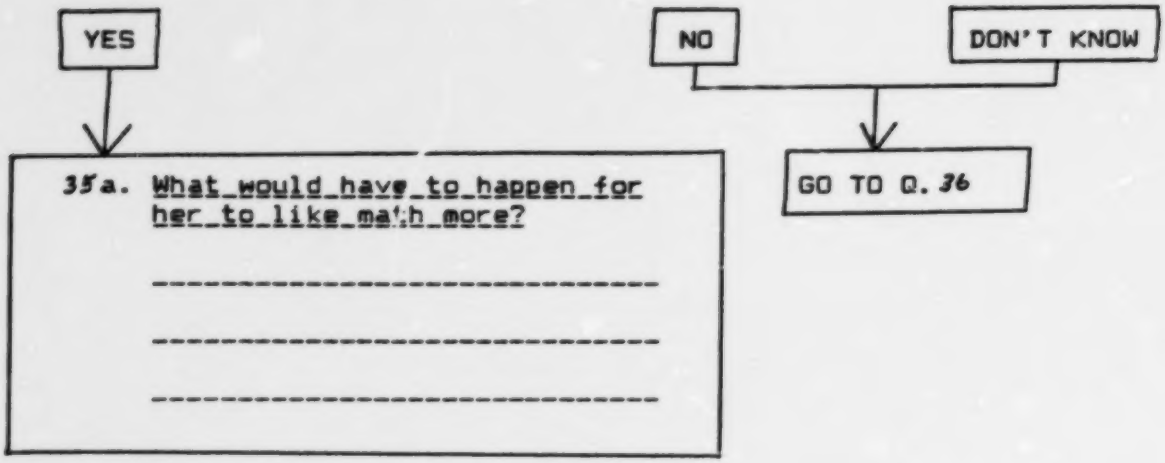
33a. What would have to happen for them to improve?

---

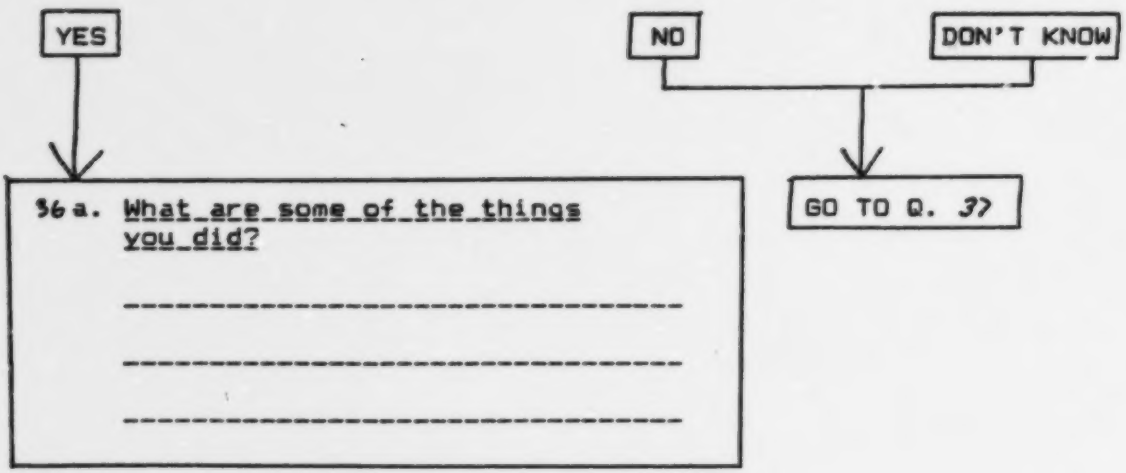
34. How does [_____] feel about mathematics? Would you say that she likes math a great deal, likes math somewhat, neither likes nor dislikes math, dislikes math somewhat, or really dislikes it?


LIKES A GREAT DEAL
LIKES SOMEWHAT
NEITHER
DISLIKES SOMEWHAT
REALLY DISLIKES
DK
GO TO Q. 35
34a. What kinds of things did she say or do that made you realize that she felt this way about math?
34b. How old was she when you first realized that she felt this way about math?
34c. Was there a time when she liked or disliked math more than she does now?
YES
NO
DON'T KNOW
GO TO Q. 35
34d. Did she enjoy it more, or less before?
MORE
LESS
DK
34e. Why do you think she changed her attitude?

35. Do you think that [ ] could ever like math better than she does now?



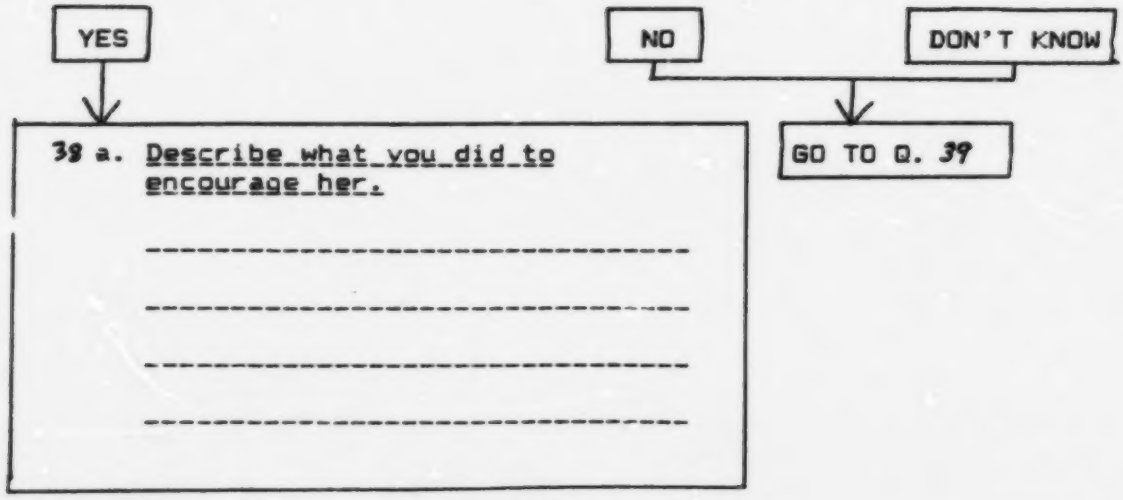
36. Have you ever encouraged [ ] in learning math or science?



37. Have you done any of the following with [_____]? Just answer yes or no to each item I read.

Bought her educational toys.	____YES	____NO	____DK
Bought her mathematical or scientific type toys.	____YES	____NO	____DK
Encouraged her to read.	____YES	____NO	____DK
Took her to the library.	____YES	____NO	____DK
Bought her books.	____YES	____NO	____DK
Played word puzzles with her.	____YES	____NO	____DK
Played chess, or other games of strategy with her.	____YES	____NO	____DK
Played card games with her.	____YES	____NO	____DK
Taught her how to build things.	____YES	____NO	____DK
Taught her how to make change.	____YES	____NO	____DK
Taught her how to tell time.	____YES	____NO	____DK
Taught her to work math puzzles and problems.	____YES	____NO	____DK
Bought a home computer for the family	____YES	____NO	____DK
Taught her to program a computer.	____YES	____NO	____DK

38. Have you actively encouraged your daughter to pursue a career in math or science?



39. Now I'd like to ask you something a bit different. If you had to choose the 3 most important ideas or values in life to teach your daughter, what would they be?

1. _____

2. _____

3. _____

The next portion of ther survey involves a series of statements that I would like you to respond to. There are no correct answers for these statements; they have been set up in a way which permits you to indicate the extent to which you agree or disagree with the ideas expressed. If the written instructions for any of the 3 parts seem unclear, please ask me.

GIVE THE RESPONDENT THE WRITTEN QUESTIONS. WHEN THE RESPONDENT IS FINISHED, CONTINUE WITH THE SURVEY ON PAGE 17.

Now, to finish up the survey, I need to get some information about you and your family.

149. How old are you? _____

150. Were you born in the United States?

YES → GO TO Q. 151

NO → 150a. What country were you born in?

_____

151. Is English your best language?

YES → GO TO Q. 152

NO → 151a. What language do you prefer to speak?

_____

152. How would you describe your race or ethnic origin?

____ AMERICAN INDIAN OR ALASKAN NATIVE

____ BLACK OR AFRO-AMERICAN

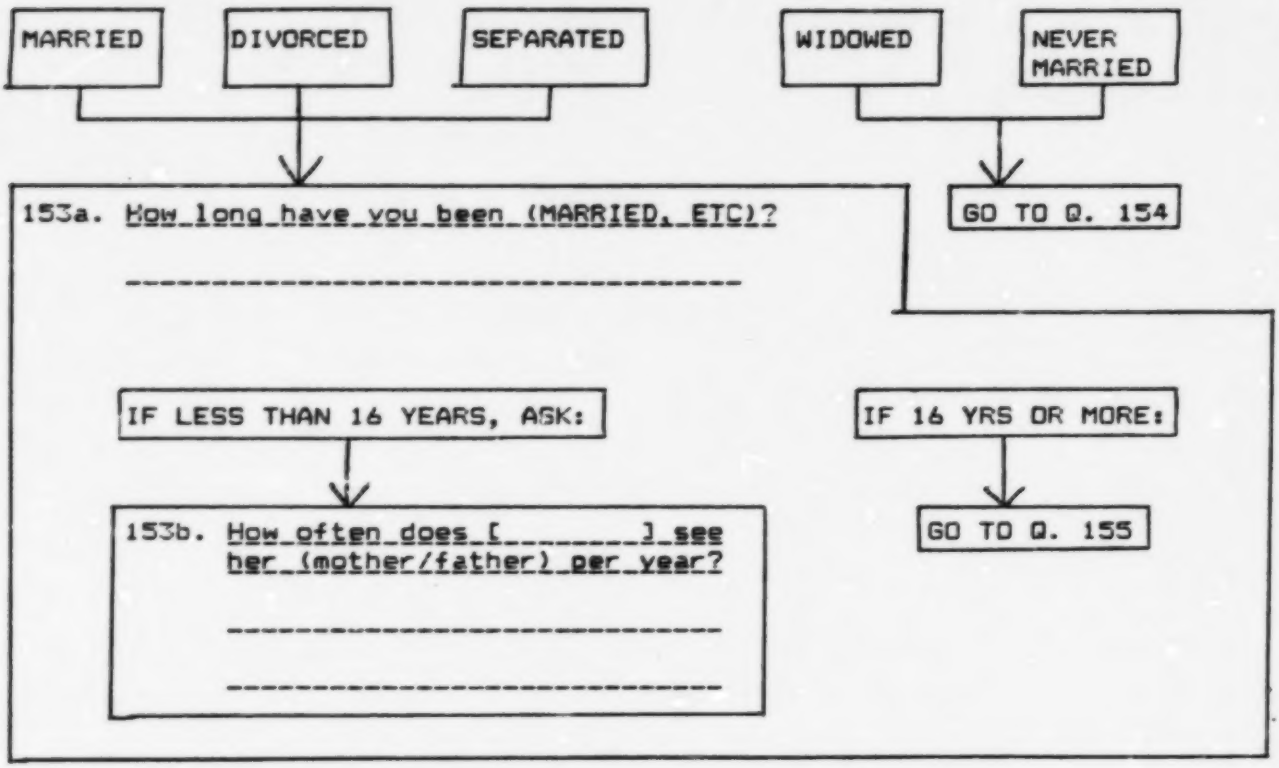
____ MEXICAN-AMERICAN OR HISPANIC

____ ORIENTAL OR ASIAN AMERICAN OR PACIFIC ISLANDER

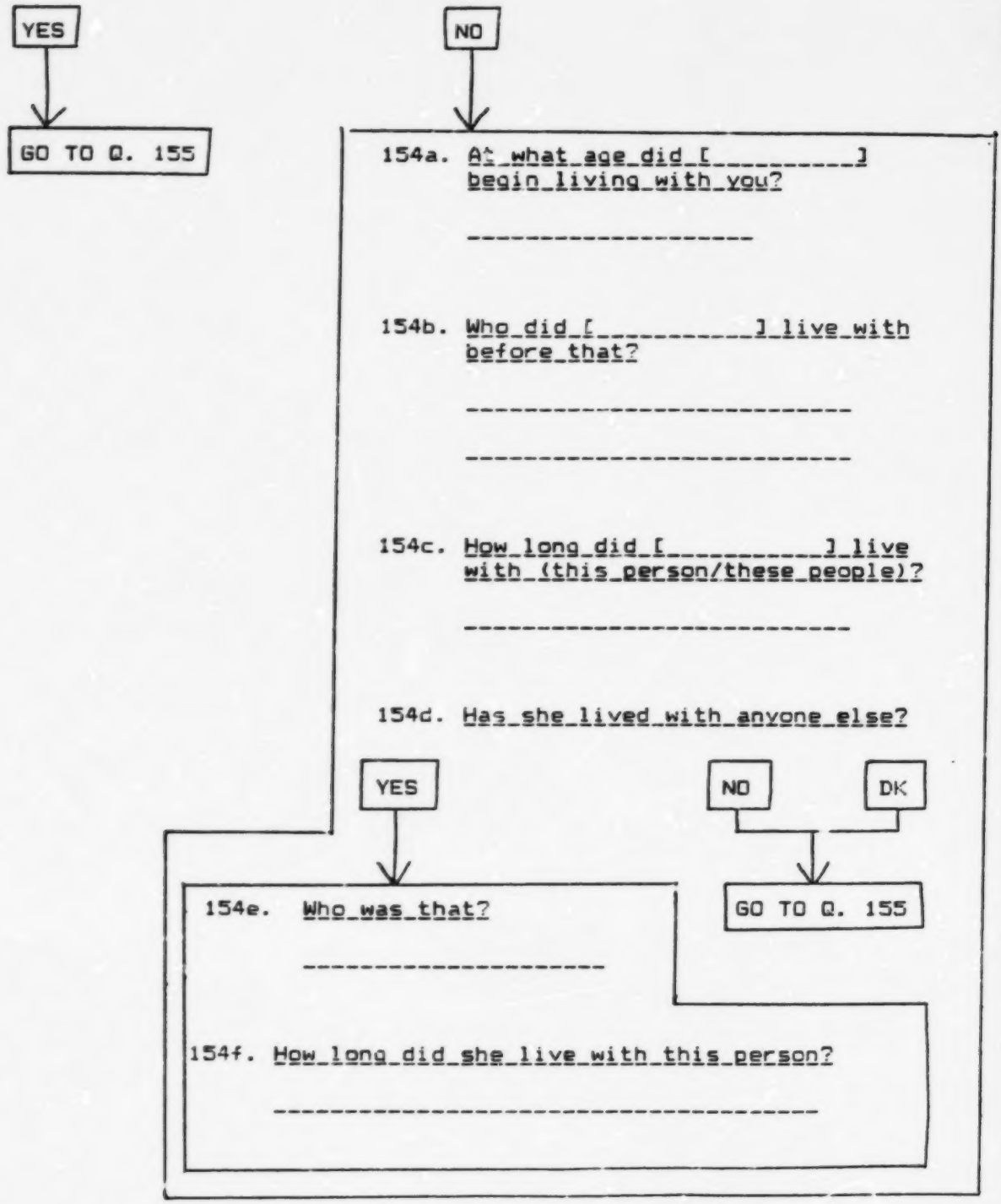
____ WHITE OR CAUCASIAN

____ OTHER, LIST:_____

153. Are you married, separated, divorced, widowed, or have you never been married?



154. Has [_____] always lived with you?



155. How many people live here in your household? _____

156. Please give me their ages and their relationships to [_____]. I don't need any names.

PERSON #	RELATIONSHIP TO daughter	SEX	AGE
1	(RESPONDENT)		X
2			
3			
4			
5			
6			
7			
8			
9			

156a. What is the highest grade or year of college you completed?

_____

157. Do you have any diplomas or degrees?

YES → 157a. What are they?

_____

_____

NO → GO TO Q. 158

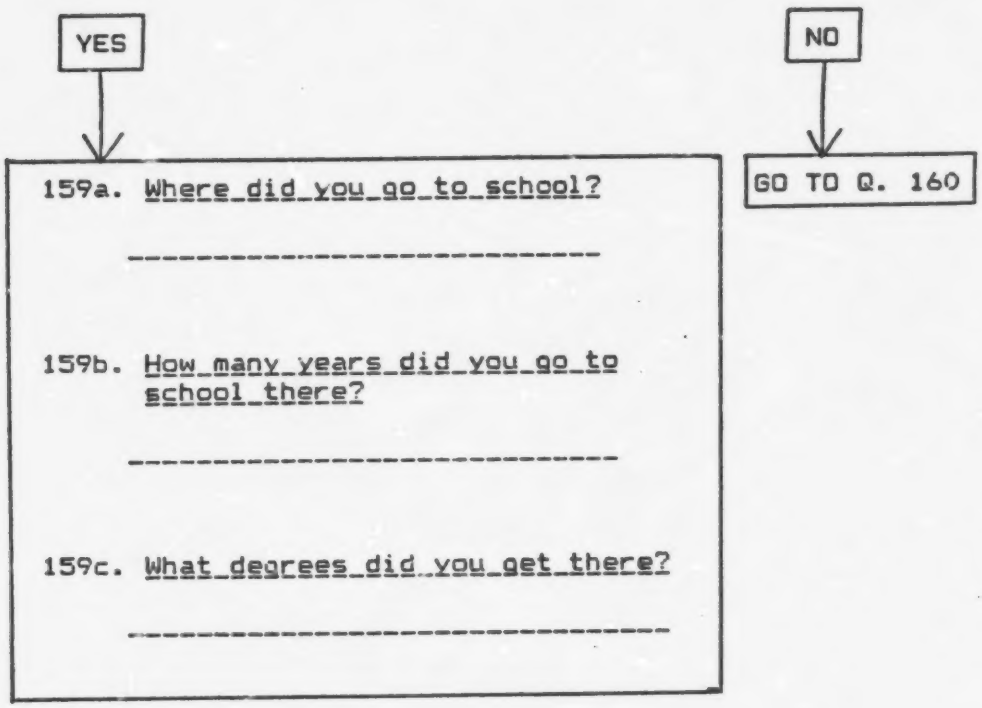
158. Have you had any other schooling, such as vocational schooling, beauty college, or technical training?

YES → 158a. What was that?

_____

NO → GO TO Q. 159

159. Did you obtain any of your education outside of the United States?



160. Do you currently have a full time job?

YES

160a. What kind of work do you do?

_____

160b. On the average, how many hours do you work per week? _____

160c. How long have you been doing this type of work? _____

NOW GO TO Q. 163

NO

GO TO Q. 161

161. Do you work part-time?

YES

161a. What type of work do you do?

_____

161b. On the average, how many hours do you work per week?

_____

Now Go To Q. 163

NO

GO TO Q. 162

162. Have you ever had a full or part-time job?

YES

162a. Are you now retired, unemployed, on sick leave, or disability, or are you a full time homemaker?

RETIRED | UNEMPL. | SICK DISAB. | HOMEMAKER

NO

162b. Are you a full time homemaker?

YES | NO

GO TO Q. 164

163. Could you just briefly tell me about the various jobs you've held during the past few years or so and how long you worked at each of them?

Job Title	# of Years
_____	_____
_____	_____
_____	_____
_____	_____

164. Have you enrolled in a University or Junior College in the last few years?

YES

NO → GO TO Q. 165

164a. Where were you enrolled?

_____

164b. How long were you enrolled for?

_____

164c. Were you taking courses just for your own enjoyment or enrichment, for your work, or to complete a degree?

ENJOYMENT | WORK | DEGREE | DK

164d. Did you receive any degrees?

YES | NO

165. When [_____] was growing up, did you stay at home, work or attend school part time, or did you work or attend school full time?

STAYED HOME | WORK/SCHOOL PART-TIME | WORK/SCHOOL FULL TIME | N/A

I need to ask one final question about your financial status so that we can compare our data with other research findings. I want to assure you that your answer is voluntary, and that the information you give me will be kept entirely confidential.

166. Thinking about your family's total income from all sources, approximately how much was it last year?

---------- DK N/A

IF RESPONDENT IS HESITANT TO ANSWER, ASK:

Was it more than

10,000 ___

20,000 ___

25,000 ___

30,000 ___

35,000 ___

40,000 ___

45,000 ___

50,000 ___

That's all of the questions I have for you. Thank you very much for your time.

THUMBNAIL SKETCH

1. R's understanding of the questions was...

EXCELLENT | GOOD | FAIR | POOR

2. R's interest in providing useful answers was...

EXCELLENT | GOOD | FAIR | POOR

3. Please provide a few words about this respondent which would help you remember the interview if you had to recall it later.

4. Please describe any ambiguous or conflicting situation that you want Coding to know about.

NONE

5. Were there any serious problems with the interview, such as R's difficulty in hearing or understanding the questions, etc., which affected the quality of the interview?

NO

As you read each statement, decide if you agree or disagree with it. If you strongly agree, circle the letters SA (which stand for strongly agree). If you agree but with reservations, that is, you do not fully agree, circle the letter A (which stands for agree). If you disagree with the idea, indicate the extent to which you disagree by circling the letter D if you disagree or letters SD if you strongly disagree. If you neither agree or disagree, that is, you are not certain, circle letter U (which stands for undecided). Also, if you cannot answer a question, circle letter U. Please mark an answer for each statement.

Circle the letters that correspond to your answer:

SA=Strongly Agree A=Agree U=Undecided D=Disagree SD=Strongly Disagree

1.	The most popular high school or college students are never the smartest.....	SA	A	U	D	SD
2.	Taking a lot of math courses in high school is important for my daughter.....	SA	A	U	D	SD
3.	Careers in engineering and computer science are more appropriate for men than for women.....	SA	A	U	D	SD
4.	I really enjoy using a computer.....	SA	A	U	D	SD
5.	Women should take increasing responsibility for leadership.....	SA	A	U	D	SD
6.	I am good at math.....	SA	A	U	D	SD
7.	I think I could handle difficult mathematics.....	SA	A	U	D	SD
8.	When a math problem arises that I can't immediately solve, I stick with it until I have the solution....	SA	A	U	D	SD
9.	I need mathematics for my work.....	SA	A	U	D	SD
10.	Math doesn't scare me at all.....	SA	A	U	D	SD
11.	Females are as good as males in geometry.....	SA	A	U	D	SD
12.	I like to do my very best in whatever I undertake...	SA	A	U	D	SD
13.	Girls who are really smart are just as popular as boys who are really smart.....	SA	A	U	D	SD
14.	I love to play games of strategy, such as chess.....	SA	A	U	D	SD
15.	It will be very important for my daughter to know how to balance a checkbook someday.....	SA	A	U	D	SD
16.	Men should share in household tasks.....	SA	A	U	D	SD

17.	I hate to balance my checkbook.....	SA	A	U	D	SD
18.	I always got good grades in mathematics.....	SA	A	U	D	SD
19.	When a mathematics question is left unanswered, I continue to think about it afterward.....	SA	A	U	D	SD
20.	I studied mathematics because I know how useful it is.....	SA	A	U	D	SD
21.	Mathematics makes me feel uneasy and confused.....	SA	A	U	D	SD
22.	Studying mathematics is just as appropriate for women as for men.....	SA	A	U	D	SD
23.	I would like to accomplish something of great significance.....	SA	A	U	D	SD
24.	I encourage my daughter to be independent.....	SA	A	U	D	SD
25.	A lot of high school boys look down on girls who get good grades in math.....	SA	A	U	D	SD
26.	Math was my favorite subject in school.....	SA	A	U	D	SD
27.	It will be very important for my daughter to be able to program a computer.....	SA	A	U	D	SD
28.	Women should be as free as men to propose marriage..	SA	A	U	D	SD
29.	I could figure out my income taxes if I had to.....	SA	A	U	D	SD
30.	I have a lot of self-confidence when it comes to math.....	SA	A	U	D	SD
31.	I'm challenged by mathematical problems I can't understand immediately.....	SA	A	U	D	SD
32.	Mathematics is of no relevance to my life.....	SA	A	U	D	SD
33.	I would trust a woman just as much as I would trust a man to figure out important calculations....	SA	A	U	D	SD
34.	I would like to be a recognized authority in some job, profession, or field of specialization.....	SA	A	U	D	SD
35.	I think my daughter should stop working when she has a family.....	SA	A	U	D	SD
36.	It will be very important for my daughter to be able to figure out interest rates/payments.....	SA	A	U	D	SD
37.	Sons rather than daughters should be encouraged to go to college.....	SA	A	U	D	SD

38.	It's important that my daughter know how a computer works.....	SA	A	U	D	SD
39.	I'm no good at math.....	SA	A	U	D	SD
40.	The challenge of mathematical problems does not appeal to me.....	SA	A	U	D	SD
41.	When I was a teenager, I thought I would have little use for mathematics when I got out of school.....	SA	A	U	D	SD
42.	Girls can do just as well as boys in mathematics....	SA	A	U	D	SD
43.	I like to be able to say that I have done a difficult job well.....	SA	A	U	D	SD
44.	High school girls who take advanced math courses don't seem to get dates as much as other girls.....	SA	A	U	D	SD
45.	It will be very important for my daughter to understand a little about how to invest money.....	SA	A	U	D	SD
46.	Women should be concerned primarily with child rearing and house tending.....	SA	A	U	D	SD
47.	I don't think I could do advanced mathematics.....	SA	A	U	D	SD
48.	I don't understand how some people can spend so much time on mathematics and seem to enjoy it.....	SA	A	U	D	SD
49.	Males are not naturally better than females in mathematics.....	SA	A	U	D	SD
50.	I like to be able to do things better than other people can.....	SA	A	U	D	SD
51.	If I had to choose, I would rather my daughter be popular than do well in school.....	SA	A	U	D	SD
52.	It will be very important for my daughter to understand calculus.....	SA	A	U	D	SD
53.	It is insulting for women to have to obey their husbands.....	SA	A	U	D	SD
54.	For some reason, mathematics always seemed unusually hard for me.....	SA	A	U	D	SD
55.	I do as little work with mathematics as possible....	SA	A	U	D	SD
56.	Women certainly are logical enough to do well in mathematics.....	SA	A	U	D	SD

57.	I like to solve puzzles and problems that other people have difficulty with.....	SA	A	U	D	SD
58.	It will be very important for my daughter to be able to solve simultaneous equations.....	SA	A	U	D	SD
59.	Women should worry less about rights and more about being good wives and mothers.....	SA	A	U	D	SD
60.	It's hard to believe a female could be a genius in mathematics.....	SA	A	U	D	SD
61.	Girls who enjoy studying math are a bit peculiar....	SA	A	U	D	SD
62.	It is useful for a woman to have a good math background.....	SA	A	U	D	SD
63.	Women who have children should not work.....	SA	A	U	D	SD
64.	When a woman has to solve a math problem, it is feminine to ask a man for help.....	SA	A	U	D	SD
65.	Mathematics is for men; arithmetic is for women.....	SA	A	U	D	SD
66.	I would have more faith in the answer for a math problem solved by a man than a woman.....	SA	A	U	D	SD
67.	I would expect a woman mathematician to be a masculine type of person.....	SA	A	U	D	SD

This set of questions presents four events which might have happened to your daughter. Each event is followed by four statements which present four possible causes of the event. Think about how much you agree or disagree that these causes would explain the event if it happened to your daughter. Then mark whether you "strongly agree," "agree," are "undecided," "disagree," or "strongly disagree" with each statement as a cause of the event. You may agree or disagree with more than one statement in each section, but be sure to mark how you feel about each statement.

Event: Your daughter has not been able to keep up with most of the class in mathematics.

Causes:

68.	Students sitting around her didn't pay attention....	SA	A	U	D	SD
69.	She hasn't spent much time working on it.....	SA	A	U	D	SD
70.	The material is difficult.....	SA	A	U	D	SD
71.	She has always had a difficult time in math classes.	SA	A	U	D	SD

Event: Your daughter was able to understand a difficult unit in mathematics.

Causes:

72.	The way the teacher presented the unit helped.....	SA	A	U	D	SD
73.	Her ability is more obvious when she is challenged.....	SA	A	U	D	SD
74.	She put hours of extra study time into it.....	SA	A	U	D	SD
75.	The problems were easy because they had been covered before.....	SA	A	U	D	SD

Event: Your daughter received a low grade on a math test.

Causes:

76.	She is not the best student in math.....	SA	A	U	D	SD
77.	She studied, but not hard enough.....	SA	A	U	D	SD
78.	There were questions she never saw before.....	SA	A	U	D	SD
79.	The teacher had spent too little class time on the chapter.....	SA	A	U	D	SD

Event: Your daughter has passed most math tests with no trouble.

Causes:

80. The teacher made learning math interesting..... SA A U D SD

81. Like everyone says, she is talented in math..... SA A U D SD

82. She spent hours of extra time on this class..... SA A U D SD

83. The units were the beginning group, easy ones..... SA A U D SD

Listed below are a number of personality characteristics. We would like you to use those characteristics to describe yourself; that is, we would like you to indicate, on a scale from 1 to 7, how true of you each of these characteristics is. Please do not leave any characteristics unmarked.

Example: shy

Write a 1 if it is never or almost never true that you are shy.
Write a 2 if it usually not true that you are shy.
Write a 3 if it is sometimes but infrequently true that you are shy.
Write a 4 if it is occasionally true that you are shy.
Write a 5 if it is often true that you are shy.
Write a 6 if it is usually true that you are shy.
Write a 7 if it is always or almost always true that you are shy.

1 Never or almost never true	2 Usually not true	3 Sometimes but infrequently true	4 Occasionally true	5 Often true	6 Usually true	7 Always or almost always true

84. Defend my own beliefs	_____	99. Love children	_____
85. Affectionate	_____	100. Tactful	_____
86. Conscientious	_____	101. Aggressive	_____
87. Independent	_____	102. Gentle	_____
88. Sympathetic	_____	103. Conventional	_____
89. Moody	_____	104. Understanding	_____
90. Assertive	_____	105. Jealous	_____
91. Sensitive to needs of others	_____	106. Forceful	_____
92. Reliable	_____	107. Compassionate	_____
93. Strong personality	_____	108. Truthful	_____
94. Adaptable	_____	109. Have leadership abilities	_____
95. Dominant	_____	110. Eager to soothe hurt feelings	_____
96. Tender	_____	111. Secretive	_____
97. Conceited	_____	112. Willing to take risks	_____
98. Willing to take a stand	_____	113. Warm	_____

114. Studies have found that relatively few young women choose careers in math or science. What do you think could be some of the reasons for this finding?

A. _____

_____

_____

B. _____

_____

_____

C. _____

_____

_____

STUDENT QUESTIONNAIRE

This questionnaire is designed to give us some information about students' attitudes towards school subjects and careers, especially about mathematics and related careers. There are no right or wrong answers. We want your opinions, so just answer as honestly as you can.

READ THE QUESTIONS VERY CAREFULLY. MARK ONLY ONE ANSWER TO EACH QUESTION -- UNLESS YOU ARE SPECIFICALLY ASKED FOR MORE THAN ONE ANSWER.

A researcher will be here to help you, so if there is something that you don't understand, please ask, and the researcher will try to answer your questions.

THIS SURVEY IS BEING USED FOR RESEARCH PURPOSES ONLY. NO ONE WILL BE TOLD WHAT YOUR ANSWERS ARE.

NAME: _____ SCHOOL: _____
(last) (first)

1. Please list the first names of all the persons living in your household, and their relationship to you (i.e. mother, father, stepmother, stepfather, etc.

NAME	RELATIONSHIP TO YOU
_____	_____
_____	_____
_____	_____
_____	_____

2. How would you describe yourself?

_____ American Indian or Alaskan native
_____ Black or Afro-American
_____ Mexican-American, Chicano, or Puerto Rican
_____ Oriental or Asian-American or Pacific Islander
_____ White or Caucasian
_____ Other

3. Is English your best language?

_____ Yes _____ No

3a. If NO, what language do you prefer?

_____

4. How long have you attended this school?

_____ less than two months
_____ just since Fall of 1985 (last semester)
_____ one year or more

5. Have you had any schooling outside of the United States?

_____ Yes _____ No

5a. IF YES, where? _____

5b. What grades were you in? _____

6. Are you now a:

_____ freshman
_____ sophomore
_____ junior
_____ senior

6a. IF YOU ARE A FRESHMAN, SOPHOMORE, OR JUNIOR:
Do you plan to take more math, science, or computer science courses in high school?

_____ Yes _____ No

6b. IF YES: Which courses will you take? (List them)

_____

_____

_____

_____

7. Have you taken (or are you planning to take) more math courses than you are required to for graduation?

_____ Yes _____ No

7a. IF YES: What made you decide to take more math courses than were required?

_____

_____

7b. IF NO: What made you decide not to take more math courses than were required?

_____

_____

7c. IF NO: What could make you want to take more math courses?

_____

_____

8. Which of the following BEST describes your present high school program?

_____ academic or college preparatory
_____ general
_____ career-oriented (business, vocational, industrial arts)
_____ other

9. What kinds of math grades did you get in elementary school?

_____ mostly A's
_____ mostly B's
_____ mostly C's
_____ mostly D's
_____ mostly F's

10. What kinds of math grades did you get in middle school or junior high?

_____ mostly A's
_____ mostly B's
_____ mostly C's
_____ mostly D's
_____ mostly F's

11. Compared with your elementary and junior high school math grades, how are you doing in math now?

_____ my math grades are higher now that I'm in high school
_____ my math grades are lower now that I'm in high school
_____ my math grades are about the same as before

12. On the average, how much time do you spend doing homework per week?

_____ none
_____ less than 2 hours per week
_____ 2-4 hours per week
_____ 5-8 hours per week
_____ more than 8 hours per week

13. How much time does your mother spend helping you with your homework?

_____ none
_____ less than 2 hours per week
_____ 2-4 hours per week
_____ 5-8 hours per week
_____ more than 8 hours per week

14. How much time does your father spend helping you with your homework?

_____ none
_____ less than 2 hours per week
_____ 2-4 hours per week
_____ 5-8 hours per week
_____ more than 8 hours per week

15. If you need help in math, which person is most likely to help you?

_____ mother
_____ father
_____ both equally
_____ neither one
_____ never need help

16. When you were in elementary school and junior high school, how much did your mother help you with your homework?

_____ she never helped me
_____ she helped me occasionally
_____ she often helped me
_____ she usually helped me
_____ she always helped me

17. When you were in elementary school and junior high school, how much did your father help you with your homework?

_____ he never helped me
_____ he helped me occasionally
_____ he often helped me
_____ he usually helped me
_____ he always helped me

18. If you needed help in math, which parent was most likely to help you?

_____ mother
_____ father
_____ both equally
_____ neither one
_____ never needed help

19. Mark EACH of the activities that you have participated in while in high school. (YOU MAY MARK MORE THAN ONE ANSWER.)

_____ athletics (interscholastic, intramural, or community)
_____ ethnic or racial clubs or activities
_____ journalism, debating or dramatic activities
_____ art, music, or dance
_____ preprofessional or departmental clubs -- for example, Future Teachers of America, American Society of Civil Engineers, etc.
_____ religious activities or organizations
_____ student government
_____ part-time job
_____ full time job
_____ other
_____ none

20. On the average, how much time do you spend each week on the activities in the previous question?

_____ none
_____ 1-2 hours
_____ 3-5 hours
_____ 6-10 hours
_____ 11-15 hours
_____ 16-25 hours
_____ over 25 hours each week

21. What are your immediate plans for further education after graduating from high school?

_____ I do not plan to attend any more school
_____ I plan to go to vocational or trade school or enter apprenticeship training
_____ I plan to attend a two-year college
_____ I plan to attend a four-year college
_____ I am undecided about my plans
_____ Other. Explain: _____

21a. IF YOU PLAN TO GET FURTHER EDUCATION: When do you plan to start?

_____ right after graduation
_____ within one year of graduation
_____ other (when) _____

22. What is the highest level of education you plan to complete beyond high school?

_____ a two-year specialized training program (for example, electronics or laboratory technician
_____ a two-year associate of arts degree (A.A.) from a junior college
_____ a Bachelor's Degree (BA or BS)
_____ a Master's Degree (MA or MS)
_____ Doctor's or other professional degree (such as MD or Ph.D.)
_____ Other
_____ I am undecided
_____ I do not plan to get any degrees besides a high school diploma

23. How sure are you that you will actually reach this educational goal?

_____ very sure
_____ sure
_____ pretty sure
_____ unsure
_____ very unsure

24. IF YOU PLAN TO GO TO COLLEGE SOMEDAY: What do you think you might major in?

_____ agriculture
_____ art or music
_____ business (accounting, marketing, economics)
_____ English (reading, literature, writing, journalism)
_____ history or geography
_____ foreign languages
_____ engineering or computer sciences
_____ liberal arts -- general
_____ math
_____ science (biology, chemistry, physics, pre-med)
_____ social science (psychology, sociology, anthropology)
_____ teaching or education
_____ home economics
_____ other (list) _____
_____ don't know

25. BELOW IS A LIST OF CAREER FIELDS. If you had to choose from these careers, mark the FIVE career fields you would most like to pursue. PUT A '1' NEXT TO THE CAREER YOU WOULD LIKE BEST, A '2' NEXT TO THE CAREER YOU WOULD LIKE SECOND BEST, ETC., UP THROUGH THE FIFTH BEST.

_____ accountant
_____ architect
_____ artist or musician
_____ bank teller
_____ beauty and hair care consultant
_____ biologist
_____ bookkeeper
_____ chemist
_____ computer programmer
_____ criminal lawyer
_____ high school teacher
_____ librarian
_____ newspaper reporter
_____ nurse
_____ office manager
_____ physician
_____ police officer
_____ sales person
_____ social worker
_____ statistician

26. Now go back to the list in the last question. Mark the five careers you would LEAST like to pursue by putting a '20' by the career you would like the very LEAST, a '19' by the career you would dislike next, etc., until you have marked #'18,' '17,' and '16.'

SO, IF YOU DISLIKED 'POLICE OFFICER' THE VERY MOST, YOU WOULD PUT A '20' BY THAT CAREER, AND IF YOU DISLIKED SOCIAL WORKER LESS THAN POLICE OFFICER, BUT YOU STILL DISLIKED IT A LOT, YOU WOULD PUT A '19' BY THAT CAREER, ETC.

27. THE SAME LIST OF CAREERS IS LISTED BELOW. Mark the five careers you would most like to have IF YOU WERE A PERSON OF THE OPPOSITE SEX. Put a '1' next to the career you think you would like the most, a '2' next to the career you would like the second best, etc. up through the fifth best.

_____ accountant
_____ architect
_____ artist or musician
_____ bank teller
_____ beauty and hair care consultant
_____ biologist
_____ bookkeeper
_____ chemist
_____ computer programmer
_____ criminal lawyer
_____ high school teacher
_____ librarian
_____ newspaper reporter
_____ nurse
_____ office manager
_____ physician
_____ police officer
_____ sales person
_____ social worker
_____ statistician

28. Do you hope to have a full time job someday?

_____ Yes _____ No

28a. IF YES: What type of job do you plan to have someday?

I plan to be a: _____

29. How sure are you that you will have this job someday?

_____ very unsure
_____ unsure
_____ pretty sure
_____ sure
_____ very sure

30. Do you expect that there will be times in your adult life when you would prefer to have a part time career, or no career at all?

_____ Yes _____ No

30a. IF YES: When and why do you think you would want to work only part time, or not at all sometime.

_____

_____

31. If it were not financially necessary for you to work as an adult, would you still want to have a career?

_____ Yes _____ No

31a. Why, or why not?

_____

_____

32. Which one of the following statements will be most true for your life?

_____ I probably will have a career and not marry
_____ I probably will marry and stop working when I get married
_____ I probably will marry and continue working
_____ I probably will marry and continue working, but stop working when I have children
_____ I probably will marry, have children and continue working after I have children

33. Which of these statements is most true for you?

_____ having a family is more important to me than having a job or career
_____ having both a job or career and a family is important to me
_____ having a job or career is more important to me than having a family

34. Which of the following is most true for you?

_____ my mother thinks that it is more important for me to have a family rather than to have a good job or career
_____ my mother wants me to have both a good job or career and a family
_____ my mother thinks it is more important for me to have a good job or career than to have a family

35. Which of the following is most true for you?

_____ my father thinks that it is more important for me to have a family rather than to have a good job or career
_____ my father wants me to have both a good job or career and a family
_____ my father thinks it is more important for me to have a good job or career than to have a family

36. CHECK THE ANSWER WHICH BEST APPLIES TO YOU
Getting a good education is:

_____ very important to me
_____ somewhat important to me
_____ neither important nor unimportant
_____ somewhat unimportant to me
_____ completely unimportant to me

37. Compared with other students of your same sex in your high school class, how would you rate your popularity?

_____ I am much more popular than most students of my same sex
_____ I am somewhat more popular than most students of my same sex
_____ I am neither more nor less popular than most students of my same sex
_____ I am somewhat less popular than most students of my same sex
_____ I am much less popular than most students of my same sex

38. Compared to other students in your high school class, how do you think that you rank in general mathematical ability?

_____ much higher than most students
_____ somewhat higher than most students
_____ about the same as most students
_____ somewhat lower than most students
_____ much lower than most students

39. How old were you when you realized what your math ability was?

_____

40. Has your math ability always been at this level, or have there been times when it was higher or lower?

_____ yes, always the same
_____ no
_____ don't know

40a. If NO: Describe when it was different

_____

_____

41. Do you think that your math ability could be improved?

_____ Yes _____ No

41a. IF YES: What would have to be done to improve it?

_____

_____

41b. IF NO: Why do you think your math ability could not be improved?

_____

_____

42. Compared to other students in your high school class, how do you think that you rank in mathematics skills or achievement?

_____ much higher than most students
_____ somewhat higher than most students
_____ about the same as most students
_____ somewhat lower than most students
_____ much lower than most students

43. Have your skills always been at this level, or was there a time when they were higher or lower?

_____ yes, always at this level
_____ no
_____ don't know

43a. If NO: Describe when they were different

_____

_____

44. How do you feel about math?

_____ I like math very much
_____ math is all right
_____ I neither like nor dislike math
_____ I don't like math all that much
_____ I really dislike math

45. How old were you when you first realized that you felt this way about math?

_____

46. Have you always felt this way about math, or was there a time when you liked or disliked it more?

_____ yes, always felt this way
_____ no
_____ don't know

46a. If NO: Describe when you felt differently about math

_____

_____

47. Do you think you could ever like math better?

_____ Yes _____ No

47a. IF YES: What would have to happen for you to like math better?

_____

_____

48. How much influence does your mother have on the courses you choose in high school?

_____ no influence at all
_____ not very much influence
_____ a slight amount of influence
_____ a fair amount of influence
_____ a great deal of influence

49. How much influence does your father have on the courses you choose in high school?

_____ no influence at all
_____ not very much influence
_____ a slight amount of influence
_____ a fair amount of influence
_____ a great deal of influence

50. How much influence does your mother have on your career plans?

_____ no influence at all
_____ not very much influence
_____ a slight amount of influence
_____ a fair amount of influence
_____ a great deal of influence

51. How does your mother try to influence your career plans?

_____

_____

52. How much influence does your father have on your career plans?

_____ no influence at all
_____ not very much influence
_____ a slight amount of influence
_____ a fair amount of influence
_____ a great deal of influence

53. How does your father try to influence your career plans?

_____

_____

54. Have your parents done any of the following?

PLEASE USE AN 'M' IF ONLY YOUR MOTHER DID THIS, AN 'F' IF ONLY YOUR FATHER DID THIS, AND AN 'M & F' IF BOTH PARENTS DID THIS:

_____ bought me educational toys (blocks, puzzles, chemistry set, etc.)
_____ bought me mathematical or scientific-type toys
_____ encouraged me to read
_____ took me to the library
_____ bought me books
_____ played word puzzles with me (crossword, logic)
_____ played chess or other strategy games with me
_____ played card games with me
_____ taught me to build things
_____ taught me how to make change
_____ played counting and number games with me
_____ taught me how to tell time
_____ taught me how to work math puzzles or problems
_____ bought a home computer
_____ taught me to program a computer

55. List any people BESIDES YOUR PARENTS who have strongly influenced your career plans. These could include people you know personally or not.

NAME	RELATIONSHIP TO YOU (teacher, famous person, etc.)
_____	_____
_____	_____
_____	_____
_____	_____

On this and the following pages is a series of statements. There are no "correct" answers for these statements. They have been set up in a way which permits you to indicate the extent to which you agree or disagree with the ideas expressed. Suppose the statement is:

Example Statement: I like mathematics. SA A U D SD

As you read the statement, decide if you agree of disagree with it. If you strongly agree, circle the letters SA (which stand for strongly agree). If you agree but with reservations, that is, you do not fully agree, circle the letter A (which stands for agree). If you disagree with the idea, indicate the extent to which you disagree by circling letter D if you disagree or letters SD if you strongly disagree. If you neither agree nor disagree, that is, you are not certain, circle letter U (which stands for undecided). Also, if you cannot answer a question circle letter U.

Circle the letters that correspond to your answer:

SA=Strongly Agree A=Agree U=Undecided D=Disagree SD=Strongly Disagree

56.	If I had to choose, I would rather be popular than do well in school.....	SA	A	U	D	SD
57.	Careers in engineering or computer science are more appropriate for men than for women.....	SA	A	U	D	SD
58.	It will be very important for me to know how to balance a checkbook someday.....	SA	A	U	D	SD
59.	I really enjoy using computers.....	SA	A	U	D	SD
60.	My mother is good at math.....	SA	A	U	D	SD
61.	My father could figure out his income taxes if he had to.....	SA	A	U	D	SD
62.	Women should take increasing responsibility for leadership.....	SA	A	U	D	SD
63.	If I had good grades in school I would try to hide it from my friends.....	SA	A	U	D	SD
64.	I think I could handle more difficult mathematics...	SA	A	U	D	SD
65.	Mathematics is of no relevance to my life.....	SA	A	U	D	SD
66.	Mathematics makes me feel uneasy and confused.....	SA	A	U	D	SD
67.	Women certainly are logical enough to do well in mathematics.....	SA	A	U	D	SD
68.	My father has strongly encouraged me to do well in mathematics.....	SA	A	U	D	SD

69.	My mother thinks I'm the kind of person who could do well in mathematics.....	SA	A	U	D	SD
70.	I would like to accomplish something of great significance.....	SA	A	U	D	SD
71.	A lot of boys look down on girls who get good grades in math.....	SA	A	U	D	SD
72.	It will be very important for me to be able to program a computer someday.....	SA	A	U	D	SD
73.	I love to play games of strategy such as chess.....	SA	A	U	D	SD
74.	My mother thinks that it is very important for me to get a good education.....	SA	A	U	D	SD
75.	My father encourages me to be independent.....	SA	A	U	D	SD
76.	Men should share in household tasks.....	SA	A	U	D	SD
77.	The most popular people at school are never the smartest.....	SA	A	U	D	SD
78.	I can get good grades in mathematics.....	SA	A	U	D	SD
79.	Math doesn't scare me at all.....	SA	A	U	D	SD
80.	Females are as good as males in geometry.....	SA	A	U	D	SD
81.	My father thinks I'll need mathematics for what I want to do after I graduate from high school.....	SA	A	U	D	SD
82.	My mother wouldn't encourage me to plan a career which involves math.....	SA	A	U	D	SD
83.	I like to do my very best in whatever I undertake...	SA	A	U	D	SD
84.	It is useful for a woman to have a good math background.....	SA	A	U	D	SD
85.	Math is my favorite class.....	SA	A	U	D	SD
86.	My mother could figure out her income taxes if she had to.....	SA	A	U	D	SD
87.	My father thinks that it is very important for me to get a good education.....	SA	A	U	D	SD
88.	Women should be as free as men to propose marriage..	SA	A	U	D	SD
89.	Girls who are really smart are just as popular as boys who are really smart.....	SA	A	U	D	SD

90. I have a lot of self-confidence when it comes to math..... SA A U D SD

91. I expect to have little use for mathematics when I get out of school..... SA A U D SD

92. Studying mathematics is just as appropriate for women as for men..... SA A U D SD

93. My father thinks I'm the kind of person who could do well in mathematics..... SA A U D SD

94. My mother thinks I need to know just a minimum amount of math... ..... SA A U D SD

95. I would like to be a recognized authority in some job, profession, or field of specialization..... SA A U D SD

96. It is useful for a man to have a good math background..... SA A U D SD

97. I wish that there were more computer classes at my school..... SA A U D SD

98. My father is good at math..... SA A U D SD

99. My mother thinks that I should know something about how computers work..... SA A U D SD

100. Sons rather than daughters should be encouraged to go to college..... SA A U D SD

101. My friends think that taking a lot of math courses is important..... SA A U D SD

102. I'm no good in math..... SA A U D SD

103. I'll need mathematics for my future work..... SA A U D SD

104. I would trust a woman just as much as I would trust a man to figure out important calculations..... SA A U D SD

105. My father hates to do math..... SA A U D SD

106. My mother has strongly encouraged me to do well in mathematics..... SA A U D SD

107. I like to be able to say that I have done a difficult job well..... SA A U D SD

108. It will be very important for me to be able to figure out interest rates/payments someday..... SA A U D SD

109. My mother hates having to balance her checkbook..... SA A U D SD

110. My father thinks that I should know something about how computers work..... SA A U D SD

111. Women should be concerned primarily with child-rearing and house tending..... SA A U D SD

112. There are times when I have felt uncomfortable about being too smart..... SA A U D SD

113. For some reason even though I study, math seems unusually hard for me..... SA A U D SD

114. I am challenged by math problems I can't understand immediately..... SA A U D SD

115. Girls can do just as well as boys in mathematics.... SA A U D SD

116. My father thinks I need to know just a minimum amount of math..... SA A U D SD

117. My mother hates to do math..... SA A U D SD

118. I like to be able to do things better than other people can..... SA A U D SD

119. It will be very important for me to understand a little about how to invest money someday..... SA A U D SD

120. My father hates having to balance his checkbook..... SA A U D SD

121. My mother encourages me to be independent..... SA A U D SD

122. It is insulting for women to have to obey their husbands..... SA A U D SD

123. It would make me happy to be recognized as an excellent student in mathematics..... SA A U D SD

124. The challenge of math problems does not appeal to me..... SA A U D SD

125. Males are not naturally better than females in mathematics..... SA A U D SD

126. My father has shown no interest in whether or not I take more math courses..... SA A U D SD

127. I like to solve puzzles and problems that other people have difficulty with..... SA A U D SD

128. It will be very important for me to be able to understand calculus someday..... SA A U D SD

129. My mother thinks I should stop working when I have a family..... SA A U D SD

130. Women should worry less about rights and more about being good wives and mothers..... SA A U D SD

131. What my friends think of me is very important to me..... SA A U D SD

132. It would be really great to win a prize in mathematics..... SA A U D SD

133. I don't like people to think I'm smart in math..... SA A U D SD

134. I study mathematics because I know how useful it is..... SA A U D SD

135. It's hard to believe a female could be a genius in mathematics..... SA A U D SD

136. My mother thinks that mathematics is one of the most important subjects I have studied..... SA A U D SD

137. It will be very important for me to be able to solve simultaneous equations someday..... SA A U D SD

138. When a woman has to solve a math problem, it is feminine to ask a man for help..... SA A U D SD

139. My father thinks I should stop working when I have a family..... SA A U D SD

140. I would expect a woman mathematician to be a masculine type of person..... SA A U D SD

141. I don't think I could do advanced mathematics..... SA A U D SD

142. I don't understand how some people can spend so much time on math and seem to enjoy it..... SA A U D SD

143. I would have more faith in the answer for a math problem solved by a man than a woman..... SA A U D SD

144. Women who have children should not work..... SA A U D SD

145. Being regarded as smart in mathematics would be a great thing..... SA A U D SD

146. When a question is left unanswered in math class, I continue to think about it afterward..... SA A U D SD

147. Girls who enjoy studying math are a bit peculiar.... SA A U D SD

148. When a math problem arises that I can't immediately solve, I stick with it until I have the solution.... SA A U D SD

149. People would think I was some kind of a nerd if I got A's in math..... SA A U D SD

150. Girls who take advanced math classes don't seem to get dates as much as other girls..... SA A U D SD

151. I do as little work in math as possible..... SA A U D SD

152. It would make people like me less if I were a really good math student..... SA A U D SD

153. Mathematics is for men; arithmetic is for women..... SA A U D SD

This next set of questions presents an event which might have happened to you, followed by four statements which are possible causes of the event. Think about whether or not each of these causes would explain the event if it happened to you. Then mark whether you "strongly agree," "agree," are "undecided," "disagree," or "strongly disagree" with each statement as a possible cause of the event if it happened to you.

Event: You have not been able to keep up with most of the class in mathematics.

Causes:

154. Students sitting around you didn't pay attention.... SA A U D SD

155. You haven't spent much time working on it..... SA A U D SD

156. The material is difficult..... SA A U D SD

157. You have always had a difficult time in math classes..... SA A U D SD

Event: You were able to understand a difficult unit of mathematics.

Causes:

158. The way the teacher presented the unit helped..... SA A U D SD

159. Your ability is more obvious when you are challenged..... SA A U D SD

160. You put hours of extra study time into it..... SA A U D SD

161. The problems were easy because they had been covered before..... SA A U D SD

Event: You received a low grade on a math test.

Causes:

162.	You're not the best student in math.....	SA	A	U	D	SD
163.	You studied, but not hard enough.....	SA	A	U	D	SD
164.	There were questions you'd never seen before.....	SA	A	U	D	SD
165.	The teacher had spent too little class time on the chapter.....	SA	A	U	D	SD

Event: You have passed most math tests with no trouble.

Causes:

166.	The teacher made learning math interesting.....	SA	A	U	D	SD
167.	Like everyone says, you're talented in math.....	SA	A	U	D	SD
168.	You spent hours of extra time on this class....	SA	A	U	D	SD
169.	The units were the beginning group, easy ones.....	SA	A	U	D	SD

A number of personality characteristics are listed below. We would like you to use those characteristics to describe yourself, that is, we would like you to indicate, on a scale from 1 to 7, how true of you each of these characteristics is. Please do not leave any characteristic unmarked.

Example: shy

Write a 1 if it is never or almost never true that you are shy.
Write a 2 if it usually not true that you are shy.
Write a 3 if it is sometimes but infrequently true that you are shy.
Write a 4 if it is occasionally true that you are shy.
Write a 5 if it is often true that you are shy.
Write a 6 if it is usually true that you are shy.
Write a 7 if it is always or almost always true that you are shy.

1 Never or almost never true	2 Usually not true	3 Sometimes but infrequently true	4 Occasionally true	5 Often true	6 Usually true	7 Always or almost always true

170.	Defend my own beliefs	185.	Have leadership abilities
171.	Affectionate	186.	Eager to soothe hurt feelings
172.	Conscientious	187.	Secretive
173.	Independent	188.	Willing to take risks
174.	Sympathetic	189.	Warm
175.	Moody	190.	Adaptable
176.	Assertive	191.	Dominant
177.	Sensitive to needs of others	192.	Tender
178.	Reliable	193.	Conceited
179.	Strong personality	194.	Willing to take a stand
180.	Understanding	195.	Love children
181.	Jealous	196.	Tactful
182.	Forceful	197.	Aggressive
183.	Compassionate	198.	Gentle
184.	Truthful	199.	Conventional

200. Studies have found that relatively few young women choose careers in math or science. What are some of the reasons that YOU can think of for this finding?

(1) _____

_____

(2) _____

_____

(3) _____

_____

Thanks very much.

APPENDIX B

Math-Relatedness of Occupations
Scale Used in The Study

Math-Relatedness of a Sample of Occupations

Math-Relatedness Score[1]	Career or Occupation
4	Accountant, auditor, actuary, treasurer, controller (Business Manager)
1	Actor, entertainer, musician, performer, broadcaster
2	Administrator, business executive, business, businessowner
2	Administrator, official, government program, local, state, and federal (not school)
1	Advertising, public relations executive, also columnist, merchandising, marketing
2	Agricultural extension worker
1	Agricultural worker
4	Architect, urban planner, landscape architect
1	Artist, sculptor, painter, designer, etc., photographer
1	Athlete, professional
1	Beautician, baker, masseuse
1	Bookkeeper, accounts clerk, cashier, data entry, bank teller
1	Clergy, religious worker
2	College or university administrator (Dean, etc.)
4	College teacher, math or science
2	College teacher, other
4	Computer systems analyst, scientist, high level
1	Cooks, food and beverage preparation and serving, servers, maids, bellhops, etc.
2	Dentist, doctor, veterinarian, pharmacist, all specialties
1	Dietician, nutritionist
3	Draftsperson, graphic artist, illustrator
1	Dry cleaners, laundry workers, shoe repair, tailors--sewing

Math-Relatedness Score[1]	Career or Occupation
4	Economist, financier
1	Editor
2	Educational administrator--principal, etc., high school or elementary
4	Educator, high school math or science teacher
1	Educator, other teacher--unspecified
2	Electrician
3	Electronic Technician
4	Engineer: Aeronautical, civil, metallurgical, chemical, electrical, mechanical, industrial, computer, mining
4	Forester, conservationist, scientist, geologist, oceanographer, earth sciences
2	Health Technician
1	Humanities occupation: Historian, philosopher, languages, English, liberal arts
1	Information clerk, receptionist
1	International relations, foreign service, diplomatic corps
1	Investigators, inspectors
1	Janitors, custodians
1	Journalist, writer
1	Law enforcement official, high sheriff, police chief, criminology
2	Lawyer
2	Librarian
3	Life scientist: Agronomist, biologist, botanist, agricultural
4	Mathematician
1	Mid-level office workers, administrators, supervisors, department heads, etc.

Math-Relatedness Score[1]	Career or Occupation
1	Military career officer
2	Nurse, registered nurse or specialty
1	Other clerks, miscellaneous clerical
2	Other professional
1	Other services
2	Personnel workers
4	Physical scientist: Astronomer, physicist, chemist
3	Pilot, ship captain, astronaut, etc.
1	Police, security workers, fire fighters
2	Purchasing agents, buyers, merchandising
1	Salesperson for food, clothing, drugs, consumables
2	Salesperson for insurance, real estate, stocks, travel agents
1	Salesperson for other
1	Secretary, typist, file clerk
3	Skilled trades (machinist, printer, cabinet maker, etc.)
2	Social scientist: archeologist, anthropologist, psychologist (not clinical), sociologist, political scientist
1	Social worker, welfare case worker
4	Statistician, data analyst
1	Teacher aides, preschool, day care workers
1	Technician, other
1	Therapist--clinical psychologist, psychiatrist, counselor

[1]Based on Sanders' (1981) poster and information on math requirements from UNR and Purdue University catalogs.

1 = Basic math required
2 = Algebra I required
3 = Geometry required
4 = Algebra II, Trig, or higher math required

APPENDIX C

Sample Colleges Representing
School Selectivity Ratings

Sample Colleges Which Represent Each Selectivity Rating Level from a Modification[1] of Cass & Birnbaum's (1985) Selectivity Index

The following schools have been selected as representative of their selectivity categories from the entire list of U. S. colleges and universities.

Selectivity Level	Value	Sample Schools in Each Category
Among the Most Selective	9	Stanford, Harvard, University of Chicago, Cornell (N.Y.), California Institute of Technology
Highly + Selective	8	Pomona College, Colorado School of Mines, Brandeis, Smith, Colgate
Highly Selective	7	Northwestern, Notre Dame, Drake, Tufts, Vassar
Very + Selective	6	Virginia Polytechnic Institute, University of Arizona, Vanderbilt, Furman, University of California-Berkeley
Very Selective	5	Emory, Georgia Institute of Technology, University of Idaho, Cornell (Iowa), Fordham
Selective +	4	University of Florida, Rutgers, Antioch, Ohio Wesleyan, University of Pittsburg
Selective	3	University of California-Los Angeles, Colorado State, Florida Institute of Technology, Bradley, Purdue
Non-Selectiwe Four-Year School	2	California State University-Sacramento, U. S. Air Force Academy, Delaware State College, Indiana University, University of Nevada-Reno
Non-Selectiwe Two-Year School	1	Any community college

[1]The final two categories (values 1 and 2) were added by the authors.